SSA3030 Spectrum Analyzer

User's Manual

SIGLENT Technologies Co.,Ltd.

Preface

Thanks for choosing SSA3030 spectrum analyzer of SIGLENT Technology Co., Ltd.! This product integrates high technology and precision and presents high cost efficiency among similar products.

We undertake to satisfy your needs to the maximum and provide you with high-quality measuring instrument as well as first-class technical support and after-sale service. We consistently follow the tenet of “good quality, considerable service” and keep the promise of providing users with satisfying products and services. We welcome your inquiry by the following means:

Service: 0755-3661 5186

Fax: 0755-3359 1582

Address: Floor3.Building 4, An Tong Da Industrial Zone, Liuxian 3rd Road,Bao’an District,Shenzhen,P.R.China.

This manual describes the usages, performance characteristics, basic working principles, use methods and precautions in use, etc. of SSA3030 spectrum analyzer produced by SIGLENT Technology Co., Ltd., in order to help you get familiar with and master the operating methods and key points in use of this instrument. In order to facilitate your proficiency in the use of this instrument, please read through this manual and correctly operate it as specified in this manual.

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Part One Instructions for Use

Chapter I Notices to User

Welcome to use SSA3030 radio frequency spectrum analyzer produced by SIGLENT Technology Co., Ltd.! Please check and verify the articles inside the package in the following procedure after unpacking, and read through the section "Precautions before Electrification" in this manual before use, in order to discover any problems as early as possible and prevent the occurrence of accidents. When you discover any problem, please contact us and we will solve it as soon as possible.

Section 1 Initial Inspection

1) Check whether the package is damaged.

2) Take the instrument out of the package, and check whether it is damaged in the process of transportation.

3) Verify against the packing list whether all the accessories and documents are supplied with the instrument.

If the package or the damping material inside the package is damaged, check whether the instrument and accessories are complete inside the package and then perform the electrical property test of the spectrum analyzer.

If the instrument is damaged during transport or has some missing accessories, please notify us. We will arrange the repair or replacement as required as soon as possible. Please reserve the transportation material for the purpose of future packing and transportation. See the section "Return of Spectrum Analyzer for Repair" in Chapter VII for the handling mode.

Section 2 Safety Precautions before Use

1 Check power supply and fuse

Spectrum analyzer employs the three-core power cable interface in compliance with international safety standards. Before electrifying the spectrum analyzer, the grounding wire must be guaranteed to be reliably grounded. Any floating grounding or poor grounding may damage the instrument and even cause personal injury.

Before start, it is necessary to confirm that the protective grounding wire of spectrum analyzer has been reliably grounded, and then insert the plug of power cord into the three-prong socket. Do not use the power cord without protective grounding wire.

Fuse is placed inside a small box under the electric socket on the rear panel, as shown in Fig. 1-1. While checking the fuse, gently pry the small box with the tip of a straight screwdriver.

The fuse on the inner side is in use. If it has any problem, it must be replaced at any time.

Fig. 1-1 Check the fuse

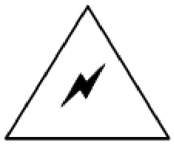
2 Allowed parameters of power supply

SSA3030 spectrum analyzer employs the 220V and 50Hz AC power supply. Table 1-1 lists the requirements for power supply during the normal operation of spectrum analyzer:

Table 1-1 Working Range of Power Supply

Parameter	Range
Voltage	220V±15%
Frequency	50Hz±10%
Maximum Power	60W

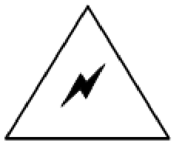
In order to prevent or reduce the mutual interference of several equipments through power supply, especially the case that the spike pulse interference caused by high power equipment may damage the hardware of spectrum analyzer, it had better employ the 220V AC regulated voltage supply for spectrum analyzer.



Warning: **With regard to power supply, if this product is sold to the regions other than Mainland China, user may select 220V or 110V AC power supply as needed according to the related instructions on the rear panel of the instrument. The AC power supply must match with the dip switch for power supply selection on the rear panel of the instrument, or it may damage the instrument!**

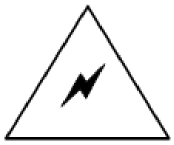
3 Selection of power cord and fuse

Spectrum analyzer employs the three-core power cable interface in compliance with international safety standards. When connecting to the appropriate electric socket, the power cord can ground the casing of the instrument. The rated voltage of power cord shall be 250V or higher, while its rated current shall be 2A or higher.



Warning: **Poor or wrong grounding may damage the instrument and even cause personal injury. Before powering on the spectrum analyzer, it is necessary to guarantee the good contact of grounding wire with the grounding wire of power supply. Use the electric socket with protective grounding wire. Do not replace the protective grounding wire with external cable, power cord and autotransformer with grounding protection. If autotransformer is used, connect the common terminal to the protective grounding wire of power connection.**

We recommend the IEC certified fuse with the diameter of 5mm, the length of 20mm, the rated current of 3A and the rated voltage of 250V.



Warning: **Before powering on the spectrum analyzer, please verify whether the supply voltage is normal, and whether the suitable fuse is mounted correctly. Any error in the verifications may damage the instrument. With regard to initial electrification, please read Section 3 "Initial Electrification of Spectrum Analyzer" in this chapter.**

4 Electrostatic protection

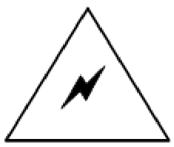
Electrostatic protection is often overlooked by user. Its damage to the instrument does not appear immediately, but may reduce the reliability of the instrument to large extent. Thus, the measure of electrostatic protection shall be taken as much as possible when conditions allow, and the correct anti-static measure shall be taken during daily operation.

Normally, we take two anti-static measures as follows:

1) Combination of conductive table mat and wrist wear.

2) Combination of conductive ground mat and ankle wear.

If such two measures are taken at the same time, they can provide the favorable anti-static guarantee. If either of them is taken separately, only the first one can provide the guarantee. In order to guarantee the safety of user, the anti-static part must be provided with the grounding isolation resistance of at least 1M.



Warning: **The aforesaid anti-static measures are not taken at any place with the voltage of over 500V!**

The anti-static technology is employed correctly to reduce the damage of components and parts:

1) Before connecting the coaxial cable with spectrum analyzer for the first time, the internal and external conductors of cable must contact the ground temporarily.

2) Any worker must wear the anti-static wristlet before touching the connecting cable or performing any assembly.

3) Guarantee that all the instruments are grounded correctly to prevent the accumulation of static electricity.

Section 3 Initial Electrification of Spectrum Analyzer

It is only required to connect the three-phase power cord in compliance with requirements to the AC power supply in compliance with requirements. No other installation is required.

Warning: **Before powering on the spectrum analyzer, please verify whether the supply voltage is normal, and whether the suitable fuse is mounted correctly. Any error in the verifications may damage the instrument.**

Warning: **When placing the instrument inside a cabinet for operation, it is necessary to guarantee the smooth air exchange inside and outside the instrument. If the total thermal power inside the cabinet exceeds 800W, the forced ventilation must be employed.**

1) Press down the [POWER] key to start up the spectrum analyzer.

2) The spectrum analyzer will spend around half a minute to execute a series of self-check and turn-up programs. After the operation of these programs is completed, the related software and hardware data will be displayed on the screen.

3) Warm up the spectrum analyzer for 5min.

Section 4 Replacement of Battery

Battery is used to provide the uninterrupted power supply for dynamic RAM. When the power of battery runs out, user’s custom information, calibration data, status and trace information will be lost very quickly when there is no power supply for the spectrum analyzer. When the voltage of battery is below +2.6V, its use and service life are limited and the output voltage decreases rapidly. When the power of battery runs out, a corresponding prompt appears in the error information area at the right upper corner of the screen after startup.

For replacement of battery, it is only needed to open the sleeve of spectrum analyzer to see the button battery slot on the motherboard, and attention must be paid to its polarity when placing the battery.

Two methods can be used to prevent the loss of user's data during replacement of battery:

1) Place the new battery within 10min after taking out the old battery.

2) Power on the spectrum analyzer before taking out the old battery.

SSA3030 radio frequency spectrum analyzer employs the lithium battery with the rated output voltage of 3V. We recommend CR1220 lithium battery produced by Panasonic Corporation with the service life of 3 to 5 years.

Attention: **Battery contains lithium and fluoride. Do not burn or break the battery. Any replaced old battery must be recycled in order to prevent it from polluting the environment and harming human body.**

Chapter II Introduction to Quick Operation

Overview

- Method of Basic Measurement
- Description of Front Panel
- Description of Rear Panel
- User Interface

Section 1 Method of Basic Measurement

Basic measurement means to display a signal on the screen of spectrum analyzer and measure the frequency and amplitude of the signal through frequency marker. The output signal can be measured in four simple steps as follows:

1) Set the center frequency;

2) Set the span, resolution bandwidth;

3) Activate the frequency marker;

4) Adjust the amplitude parameter.

For instance, measure a signal with the frequency of 100MHz and the amplitude of -30dBm. At first, power on the spectrum analyzer (30min warmup before measurement can ensure more accurate results).

Measurement Setting:

Connect the radio frequency (RF) output from the source that generates the RF signal to the RF output port of SSA3030 spectrum analyzer, and set the signal source to:

Frequency	100MHz
Amplitude	-30dBm

Subsequently, take the following steps:

Set the spectrum analyzer to the default initial status at first, and press down the [Preset] of spectrum analyzer

The spectrum analyzer displays the spectrum from 9kHz to 3GHz, which is its maximum sweep width. At the frequency of 100MHz, the signals from the signal source form a vertical straight line, while the harmonic signals appear in a straight line at the integral multiples of 100MHz. See Fig. 2-1.

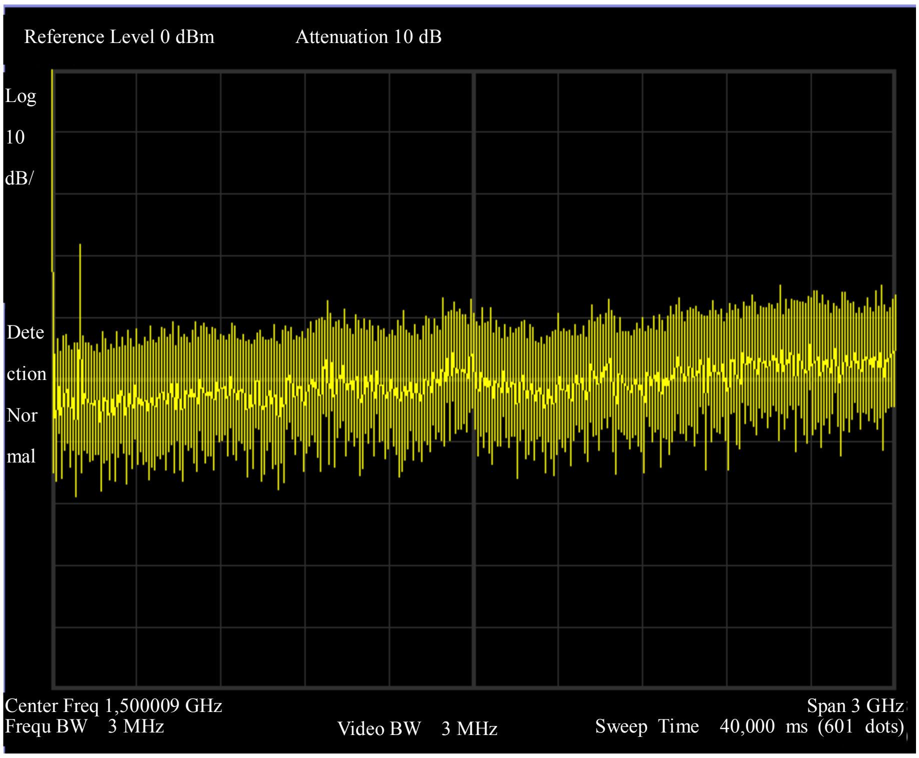


Fig. 2-1 Full Span

In order to observe the signals more clearly, reduce the sweep width. Set the center frequency of spectrum analyzer to 100MHz and reduce the span to 1MHz.

1) Set the center frequency.

a. Press the [Freq] key, press down [Center Freq], type in "100" at the num pad, and press the keys at the softkey area to set the unit of MHz. These numeric keys can be used to set the specific number of the current parameter, while the up/down keys and knob can be also used to set the value of center frequency.

2) Set the sweep width.

a. Press the [Span] key, type in "1" at the num pad, and press the keys at the softkey area to set the unit of MHz, or use the [↓] key to reduce to 1MHz.

b. Press the [BW] key, set [RBW Auto/Man], type in "30" at the num pad, and press the keys at the softkey area to set the unit of kHz, or press the [↓] key to reduce RBW to 30kHz.

c. Press the [Trace] key, set the mode of detection from "Normal" to "Positive Peak", press the [Mode of Detection] to next soft menu, and select the [Positive Peak].

Fig. 2-2 presents the display of signals generated at higher resolution. It must be noticed that the resolution bandwidth and video bandwidth are self-adaptive to and sweep bandwidth when the automatic coupling functions. They can automatically adjust to the appropriate values according to the set span. The sweep time is also self-adaptive.

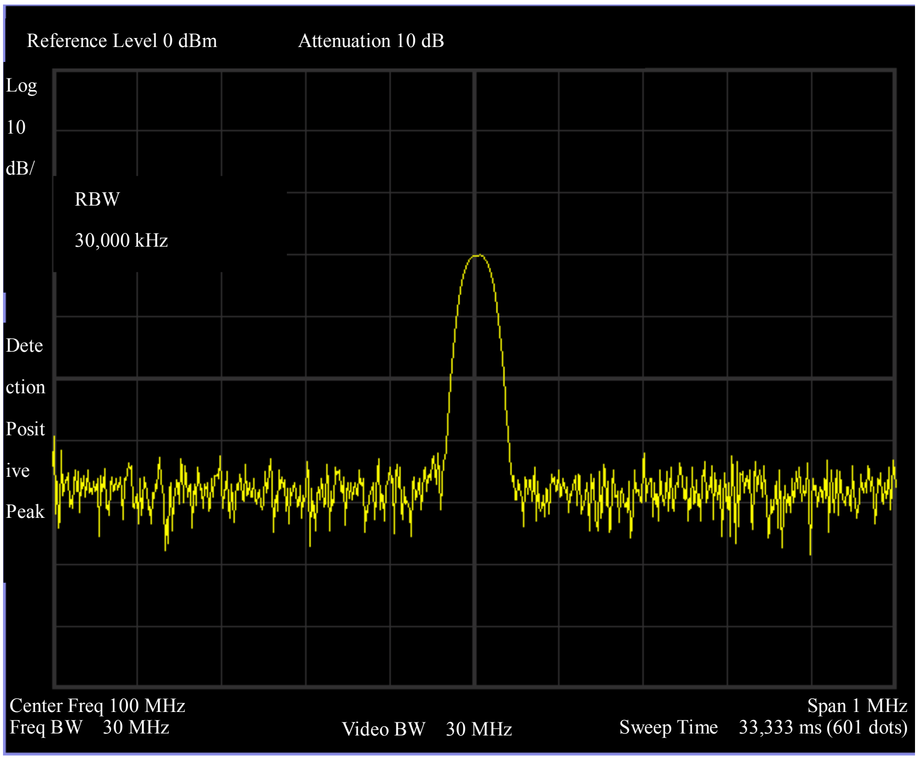


Fig 2-2 Set the span

3) Activate the frequency marker.

a. Press the [Marker] key at the function line. Press the softkey again to confirm [Freq Marker_1_2 3], select the marker 1. In this operation, the default position of frequency marker is the central position of horizontal coordinate. In other words, the spectrum trace displays the center frequency.

b. Press the [Peak] key. At this time, the instrument automatically executes the [Max Search] key. If searching any other peak of signal, please perform the corresponding operation at the soft menu.

c. Read the frequency and amplitude according to the frequency marker that is displayed in the data display area at the right upper corner of measurement graph on the screen.

4) Adjust the amplitude parameter.

The amplitude of horizontal line at the top of measurement graph displayed by the spectrum analyzer is called reference level. In order to identify a good dynamic range, the actual signal peak should be on or near the horizontal line at the top of measurement graph (i.e. reference level), but should not be higher than the reference level. The reference level is also the maximum of Y axis. The dynamic range is increased by reducing the reference level by 20dB.

a. Press the [AMPT] key to bring out the soft menu for amplitude setting and activate the soft key [Ref Level], or directly type the reference level in the input square at the left upper of measurement graph. Type in “-20” with the numeric keys, and use the soft keys to confirm the unit of dBm, or adjust it with the step key [↓] or knob.

At this time, set the reference level to -20dBm and make the trace peak close to the maximum scale of measurement graph. At this time, the difference between signal peak and noise is the expansion of dynamic range.

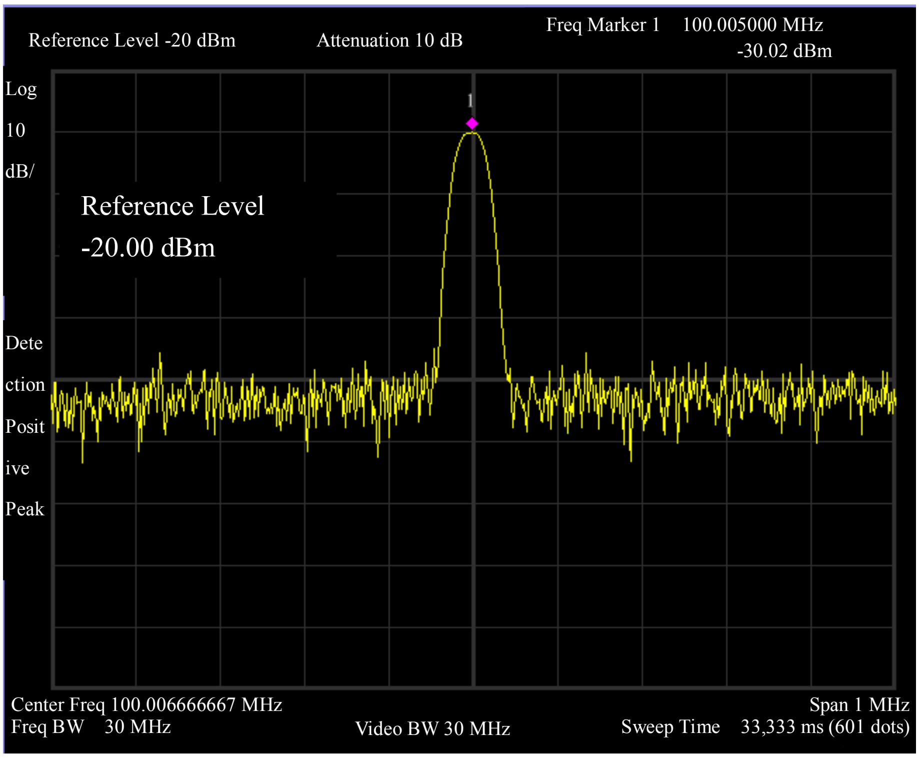


Fig. 2-3 Set the reference level

Section 2 Description of Front Panel

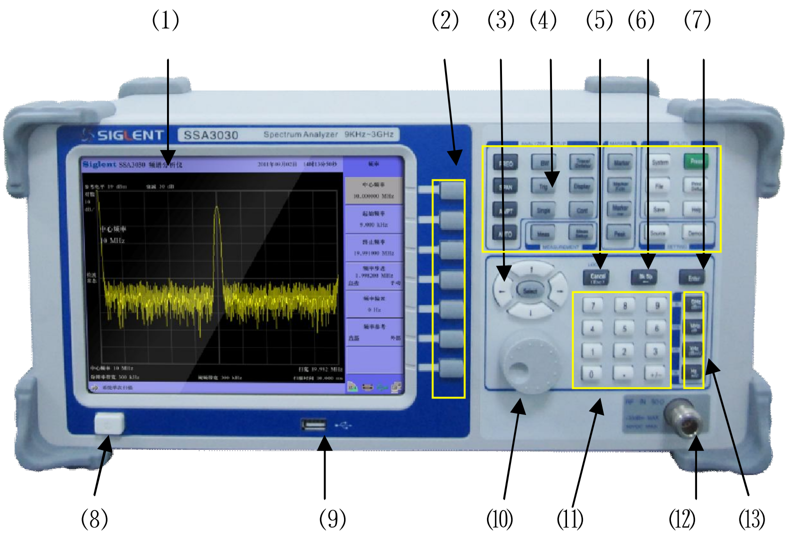


Fig. 2-4 Front Panel of SSA3030 Spectrum Analyzer

Table 2-1 Description of Front Panel

No.	Description	No.	Description
(1)	LCD Display	(8)	Power Switch
(2)	Soft Menu	(9)	USB Port
(3)	Direction Selector	(10)	Knob
(4)	Function Line	(11)	Num Pad
(5)	Cancel Key	(12)	RF Input
(6)	BK_SP Key	(13)	Unit Key Area
(7)	ENTER		

Warning: When the attenuator is set to no lower than 10dB, the maximum power of input signal at the RF input port is +33dBm. The maximum DC input voltage at the RF input port is 50V. If the voltage is exceeded, it may damage the input attenuator and input mixer.

1. Function keys on the front panel

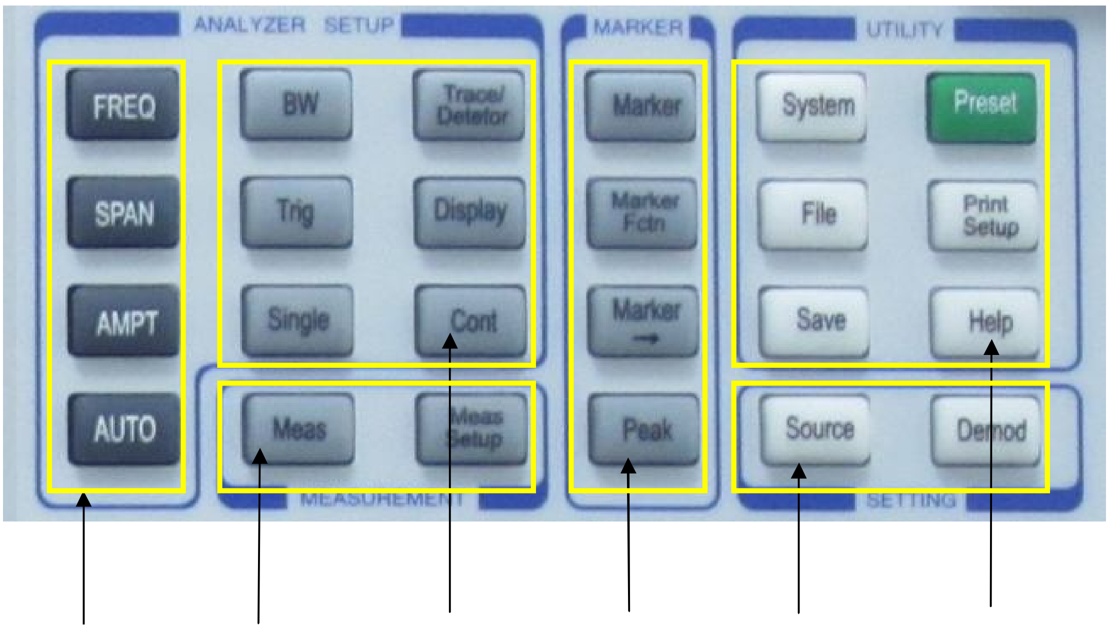


Fig. 2-5 Function Keys of Front Panel

The key areas are explained in Table 2-2.

Table 2-2 Schematic Diagram of Function Keys

Function Key	**Function Description**
Common Function Keys	
FREQ	Set the related parameters of frequency sweep, including center frequency, start frequency, stop frequency, frequency step, frequency offset and frequency reference.
SPAN	Activate the frequency span, set the spectrum analyzer to the mode of center frequency span, set the sweep width and use as the shortcut for common span operations, e.g. full span, zero span and previous span.
AMPT	Activate the reference level function to bring out the soft menu for amplitude setting. Set the related amplitude parameters of spectrum analyzer, including reference level, attenuator, scale type and proportion, etc., among which the settings of reference level and attenuator have the coupling relationship to some extent.
AUTO TUNE	Full-range auto positioning signal. Automatically search the input signals at the RF port and place the signals at the center of screen. Set the span to 1MHz to help user measure the signals quickly, and press the “Preset” key to retreat from auto search.
Parameter Setting Keys	
BW	Set the sweep-related parameters of frequency analyzer, including resolution bandwidth, video bandwidth and sweep time, etc. These parameters have the coupling relationship with sweep width to some extent. In common measurement, it is recommended to employ the mode of auto coupling.
Trig	Set the trigger mode of sweep and its corresponding parameters.
Single	Set the system to the mode of sweep single. It stops sweeping after a single sweep. It can be also performed in the bandwidth menu.
Trace/ Detetor	Set the trace measurement and display mode, and also operate the computation of related trace. Set the video detection mode of system according to the needs of user’s measurement.
Display	Set different graphic display areas and colors according to the habits of use and needs of measurement.
Cont	Set the system to the continuous sweep mode, in other words, the system repeats the sweep automatically. It can be also performed in the bandwidth menu.
Advanced Measurement	
Meas	Expanded measurement function based on the platform of spectrum analyzer, including adjacent-channel power (ACP) measurement, channel power measurement, occupied bandwidth measurement, chromatogram display, input channel select, etc. Refer to the measurement setup menu for specific setting of measurement function parameters.

Meas Setup	Advanced setup of measurement parameters. It is used together with the measurement menu to set the measurement parameters selected in the measurement menu.
Marker Measurement Keys	
Marker	Use the marker to read the amplitude, frequency or sweep time, etc. at any point on the trace, perform the setting of frequency markers 1, 2 and 3 and corresponding operations.
Marker Fctn	Special measurement function of marker. Noise marker, frequency count, N3db bandwidth.
Marker →	Use the current marker to rapidly set other corresponding parameters of the instrument.
Peak	Perform the operations related to peak of frequency marker, including positioning and operation of maximum, minimum, left and right peaks, etc.
Function Measurement Keys	
Source	Set the related parameters of instrument tracking source.
Demod	Set the related menus of audio demodulator.
System Function Keys	
System	Set the system parameters and bring out the operation menu of instrument calibration.
File	Browse, delete and export the stored files.
Save	Save the screen pictures as files in the format of png.
Preset	Restore the parameters of instrument measurement setup to the state of system startup. Set the system to the maximum sweep width and the reference level to 0dBm.
Print Setup	Set the parameters including printer type and paper type, etc.
Help	Bring out the help menu of spectrum analyzer.

2. Parameter input interface

Parameter input can be completed by means of num pad, knob and arrow keys.

(1) Num pad

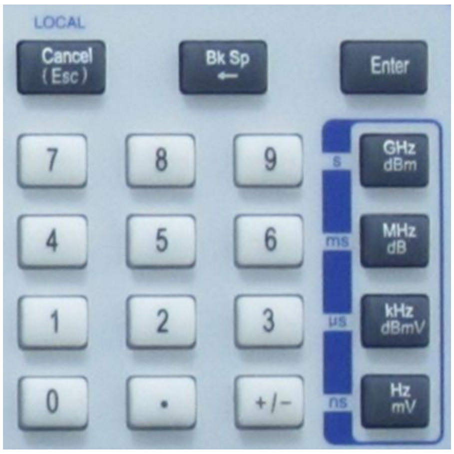


Fig. 2-6 Num Pad

1. Number key

   Number keys 0-9 can directly input the needed parameter value.

2. Decimal point

   Press the key to insert a decipal point "." at the current marker.

3. Symbol key

   Symbol key "+/-" is used to change the parameter symbol. Press the key once for the parameter symbol of "-", and press the key again for the symbol of "+".

4. Unit key

   Unit keys include GHz /dBm /s, MHz/dB/ms, kHz/dBmv/us and Hz/mv/ns. After typing in a number, press the needed unit key to complete the input. The specific connotation of a unit key is determined by the type of current input parameter, which may be "frequency", "amplitude" or "time".

5. Cancel/ESC key

   ① While inputting the parameters, press the key to cancel the input in the active function area and exit the state of parameter input.

   ② End the display in the active function area.

   ③When the instrument is put into remote control test, the key is used to exit the current state of remote control test and back to the local keyboard measurement setup.

6. Bk sp key

   ① While inputting a parameter, press the key to delete the characters on the left of marker.

   ② While editing a file name, press the key to delete the input characters.

7. Enter key

   While inputting a parameter, press the key to end the parameter input and add a default unit to the parameter.

(2) Knob

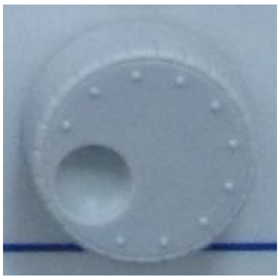


Fig. 2-7 Knob

Knob function:

When a parameter is editable, turn the knob to increase (clockwise) or reduce (counterclockwise) the parameter by the designated step.

⑶ Arrow key

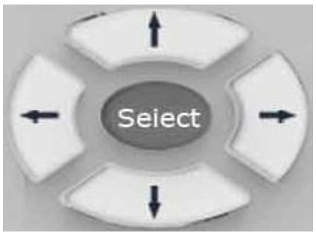


Fig. 2-8 Arrow key

Arrow key functions:

① When inputting a parameter, the arrow keys can increase or reduce the displayed parameter value by the designated step.

② In the FILE function, the arrow keys can be used to move the marker in the root directory.

③ When editing a file name, the arrow keys are used to select the neighboring reference point.

Section 3 Description of Rear Panel

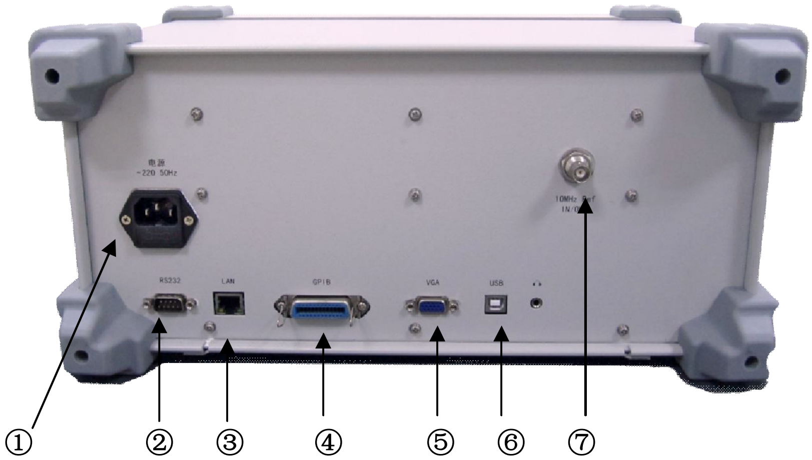


Fig. 2-9 View of Rear Panel

① AC power interface

AC: frequency 50Hz±10％ and single-phase AC 220V±15％

② RS232 serial port

Connect with other host through the serial port.

③ LAN interface

Spectrum analyzer can be connected to the remote control in the local area network through the interface. The instrument conforms to the standard of LXI category C instruments, and can rapidly construct the test system and easily realize the system integration.

④ GPIB interface

Spectrum analyzer can communicate with other host through GPIB interface.

⑤ VGA interface

The interface provides VGA video signal output and is connected through VGA connecting wire.

⑥USB-Device

Connect with other equipment through the serial port.

⑦ 10MHz reference input/output

Realize the connection with reference clock input/output interface through BNC electric cable.

Section 4 User Interface

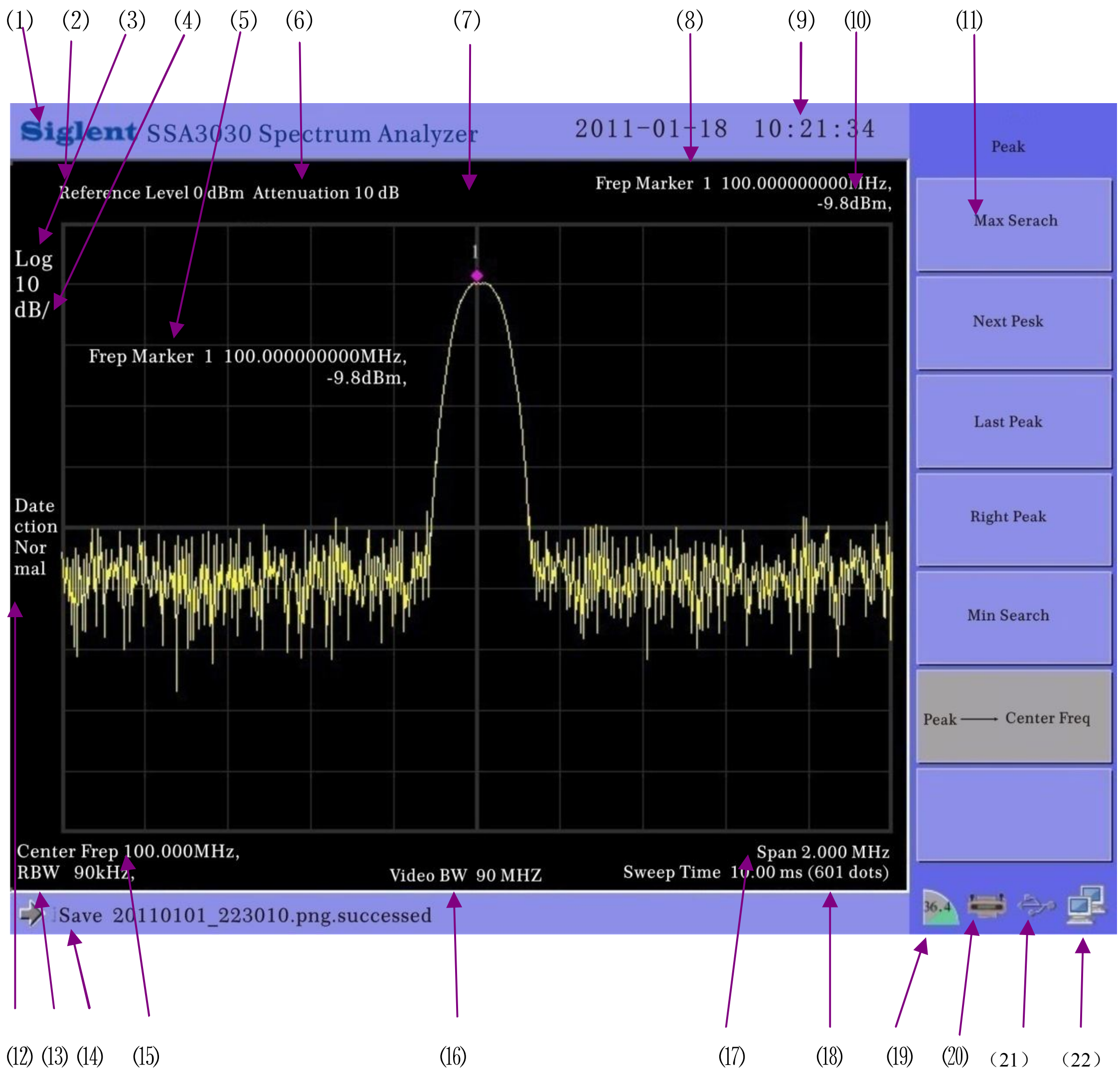


Fig. 2-10 User Interface

Table 2-3 Marks of User Interface

NO.	Name	Description
(1)	LOGO	Glarun-Atten's LOGO
(2)	Reference Level	The setting value of reference level
(3)	Display Mode	The data output mode: logarithm or linear
(4)	Scale	The setting proportion
(5)	Center Freq	Set the center frequency
(6)	Attenuation	Display the attenuation value
(7)	Peak Freq Scale	The peak frequency scale

(8)	Marker Value	Display the frequency at the point
(9)	Time	Display the date and time
(10)	Marker	The value of marker amplitude
(11)	Soft Menu	The soft submenu
(12)	Detection Mode	Display the selected detection mode
(13)	RBW	The resolution bandwidth
(14)	Wait Mark	Display the wait mark of the system
(15)	Center Freq	Display the center frequency
(16)	Video BW	Display the RBW
(17)	Span	Display the span value
(18)	Sweep Time	The sweep time of system
(19)	Temp	Monitor the temperature of instrument
(20)	GPIB	The GPIB communications mark
（21）	USB	The USB interface mark
（22）	Host Comm	The mark for communications with other host.

Chapter III Measurement

This chapter illustrates the typical applications of spectrum analyzer measuring techniques. Each application is developed for different characteristics of SSA3030 radio frequency spectrum analyzer. This chapter covers the following measuring methods and applications:

- Measure nusoidal signals
- Use frequency counter to measure signal frequencies
- Employ resolution bandwidth to resolve closely spaced signals
- Measure 3dB bandwidths
- Measure small signals
- Measure harmonic distortion
- Measure three-order intermodulation distortion (IMD)
- Measure AM modulation

Section 1 Measure Nusoidal Signals

One of the commonest measuring tasks of spectrum analyzer is to measure the frequency and amplitude of signal. The following example employs the 100MHz and -10dBm nusoidal signal output by signal generator (Agilent E4421B) as its measured signal.

Measuring Steps:

1. Connect the equipment

Connect the signal output port of signal generator to the RF input port on the front panel of SSA3030 spectrum analyzer.

2. Use the marker to measure the frequency and amplitude

①Reset the instrument

—Press the [Preset] key

② Set the parameters

—Press the [Freq] key

—Press the [Center Freq] key to input 100MHz

—Press the [Span] key

—Press the [Span] key to input 1MHz

③ Use the marker to measure the frequency and amplitude

—Press the [Freq Marker] key

—Press the [Freq Marker 1 2 3] key to activate marker 1 of spectrum analyzer\

④—Press the [Peak] key

—Press the [Max Search] key to move the marker to the peak frequency.

The marker will indicate the signal peak, and the corresponding frequency and amplitude values will appear at the right upper corner of lattice on the screen.

3. Read the measuring results

It is measured that the frequency of input signal is 100MHz and its amplitude is -10.02dBm, as shown in Fig. 3-1:

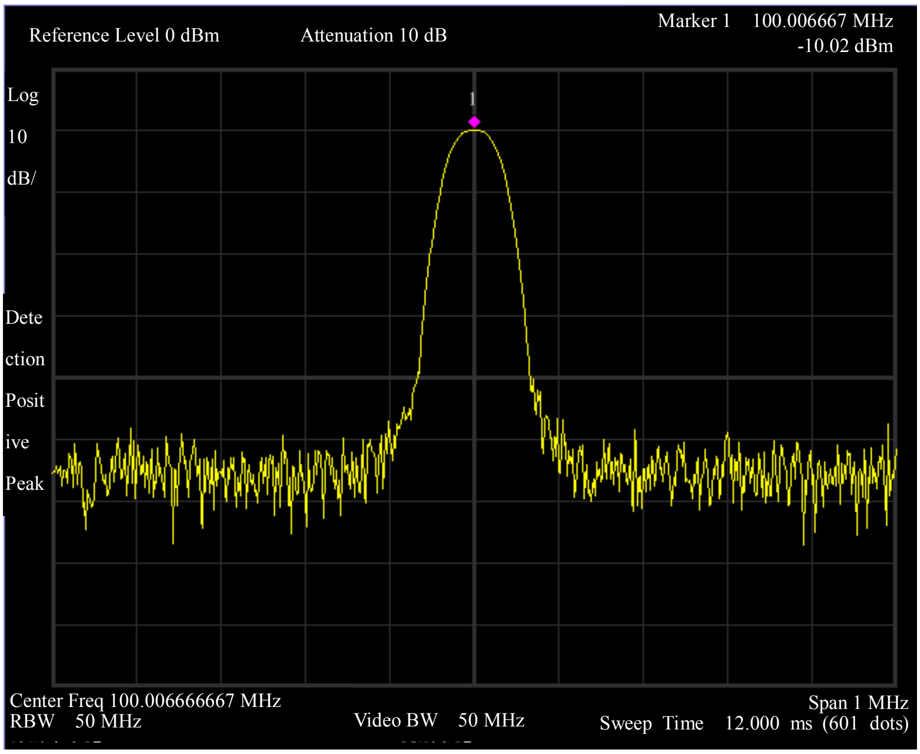


Fig. 3-1 Measuring Results of Nusoidal Signal

Section 2 Use Frequency Counter to Measure Signal Frequencies

In order to measure the signal frequencies more accurately, spectrum analyzer provides the function of frequency counter, which can measure the signal frequencies more precisely than the marker measurement. The following example employs the 100MHz and -10dBm nusoidal signal output by signal generator (Agilent E4421B) as its measured signal.

1. Connect the equipment

Connect the signal output port of signal generator to the RF input port on the front panel of SSA3030 spectrum analyzer.

2. Use the frequency counter to measure the signal frequency

①Reset the instrument

Press the [Preset] key

② Set the parameters

Press the [Freq] key and press the [Center Freq] key to input 100MHz

Press the [Span] key

Press the [Span] key to input 10 MHz

③ Use the marker to measure the frequency and amplitude

④ Press the [Freq Marker] key

Press the [Freq Marker 1 2 3] key to activate marker 1 of spectrum analyzer

⑤ Press the [Peak] key

Press the [Max Search] key to move the marker to the peak frequency, and press [Freq Marker→Center Freq].

⑥Press the [Freq Marker Fctn] key and press the [Freq Count] soft key to enter the soft submenu.

Press [Freq Count ON OFF] to start the counter.

Observe the reading of frequency marker at that time. The resolution of frequency value can reach to 1Hz, as shown in Fig. 3-2.

The function of frequency count can only measure the continuous wave signal or discrete spectrum component. The signal amplitude is higher than -50dBm, and must be higher than the noise level of 30dB. When measuring the signal with low amplitude, it is necessary to reduce the reference level, in order to guarantee the accuracy of measurement.

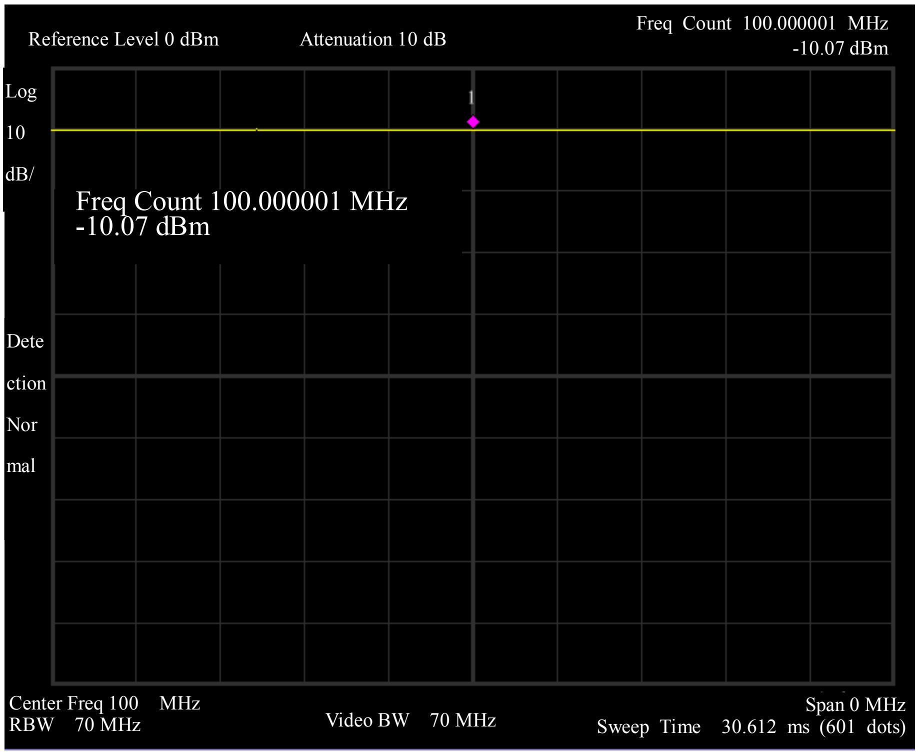


Fig. 3-2 Frequency Marker Count and Measuring Function Improves the Accuracy of Frequency Measurement

⑦ Change the resolution of frequency counter.

Press [Count Resolution] to switch among 1kHz, 100Hz, 10Hz and 1Hz as needed.

To change the resolution of counter can change the accuracy of counter. As shown in Fig. 3-3, the higher resolution, the high accuracy of counting. As shown in Fig. 3-3, the counter resolution of 1Hz can guarantee the count accuracy of 1Hz.

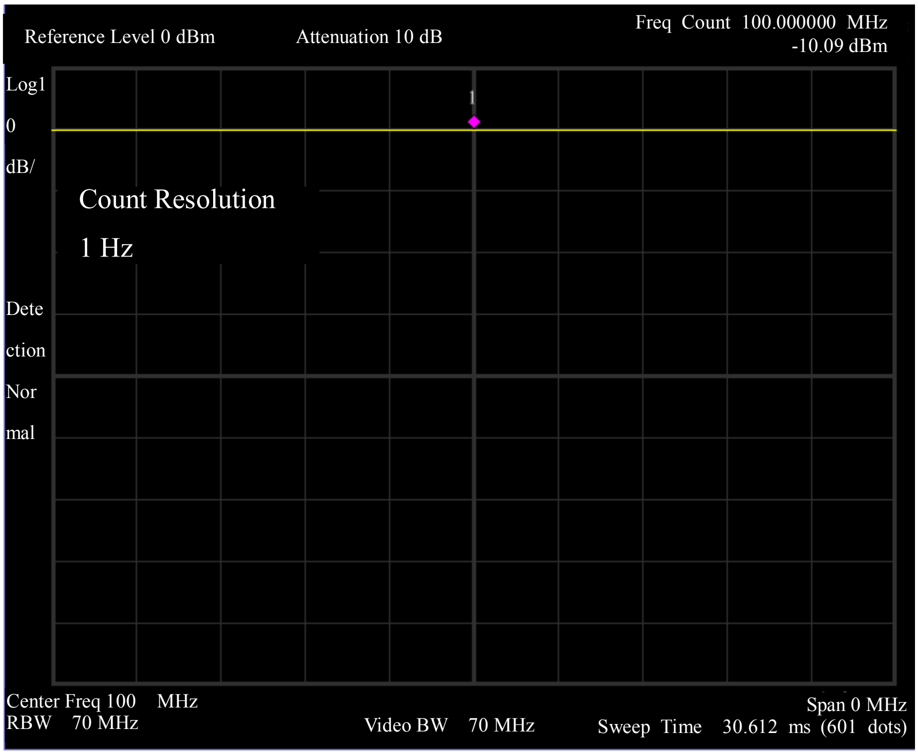


Fig. 3-3 Frequency Measuring Results

⑧ Turn off the function of frequency marker count

Press [Freq Marker Fctn] key

Press the [Freq Count] key to enter the soft submenu

Press the [Freq Count ON OFF] to turn off the counter.

Attention: When performing the function of frequency count, spectrum analyzer will count the center frequency set by user and automatically switch to zero sweep, which is normal.

Attention: When performing the function of frequency count, it is necessary to apply the same time base for signal generator and spectrum analyzer in order to accurately measure the frequency.

Section 3 Utilize Resolution Bandwidth to Resolve Closely Spaced Signals

1 Description of resolution bandwidth

The signal resolution capacity depends on the intermediate frequency (IF) filter bandwidth, i.e.

resolution bandwidth. When a signal passes the IF filter, spectrum analyzer sweeps the shape of bandpass at the IF filter through the signal. When two equi-amplitude signals have very close frequencies, it is possible that the top of the bandpass waveform swept for either of them cover almost the whole of the other signal. Thus, such two signals seem to become a signal. If such two signals have no equal amplitude, but their frequencies are very close, the smaller one may be overshadowed by the larger one.

2 Spectrum Analyzer's Function to Be Used

The function of resolution bandwidth is used to select the appropriate IF bandwidth during measurement. We take the 3dB bandwidth of filter as the resolution bandwidth. How to select the appropriate resolution bandwidth is explained hereunder.

3 Measuring Steps for Identification of Two Equi-amplitude Signals

In order to identify two equi-amplitude signals, the resolution bandwidth must be normally lower than or equal to the frequency space of such two signals. For instance, it is necessary to select the resolution bandwidth of 1kHz or lower to identify two equi-amplitude signals with the space of 1kHz.

The system connection is as shown in Fig. 3-4.

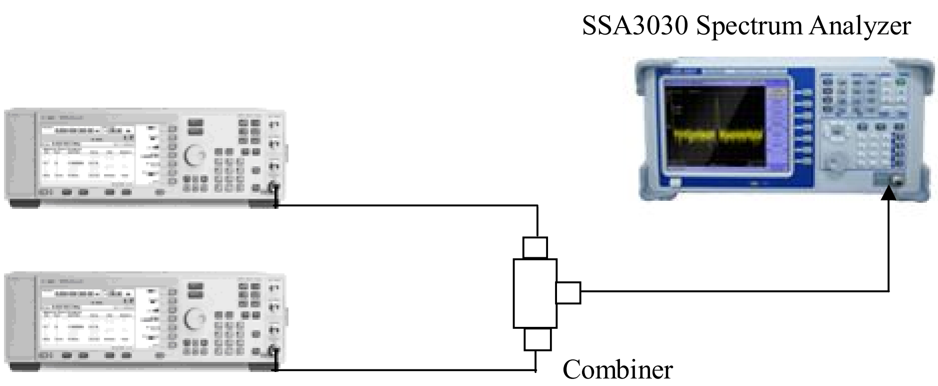


Fig. 3-4 Connection for Identifying Two Equi-amplitude Signals

1) Connect the RF input port of spectrum analyzer with two signal sources. Set the frequency of one source to 1800.4995MHz, and the frequency of the other source to 1800.5005MHz. Such two signal sources should have the same signal output amplitude, which is -10 dBm. Adjust the output amplitudes of two signal generators and observe the signals displayed on the spectrum analyzer to ensure that the signal amplitudes displayed on the spectrum analyzer are the same.

Set the signals observed on the spectrum analyzer, and set the center frequency of spectrum analyzer to 1800.5 MHz.

The resolution bandwidth is 300kHz and the bandwidth is 2MHz.

① Reset the instrument

Press the [Preset] key

② Set the parameters

Press the [Freq] key

Press [Center Freq] key to input 1800.5 MHz

Press the [Span] key

Press [Span] to input 2MHz

Press the [BW] key

Press the [RBW Auto Man] key to set the resolution bandwidth to manual and input 300kHz.

③ Observe that there is only a signal peak on the display screen of spectrum analyzer.

④ Set the resolution bandwidth to 1kHz to make the resolution bandwidth lower than or equal to the frequency space of two signals.

Press the [BW] key

Press the [RBW Auto Man] key to set the resolution bandwidth to manual and input 1kHz.

If it is seen that the peak signal on the screen becomes flat, it means that there may be two signals, as shown in Fig. 3-5.

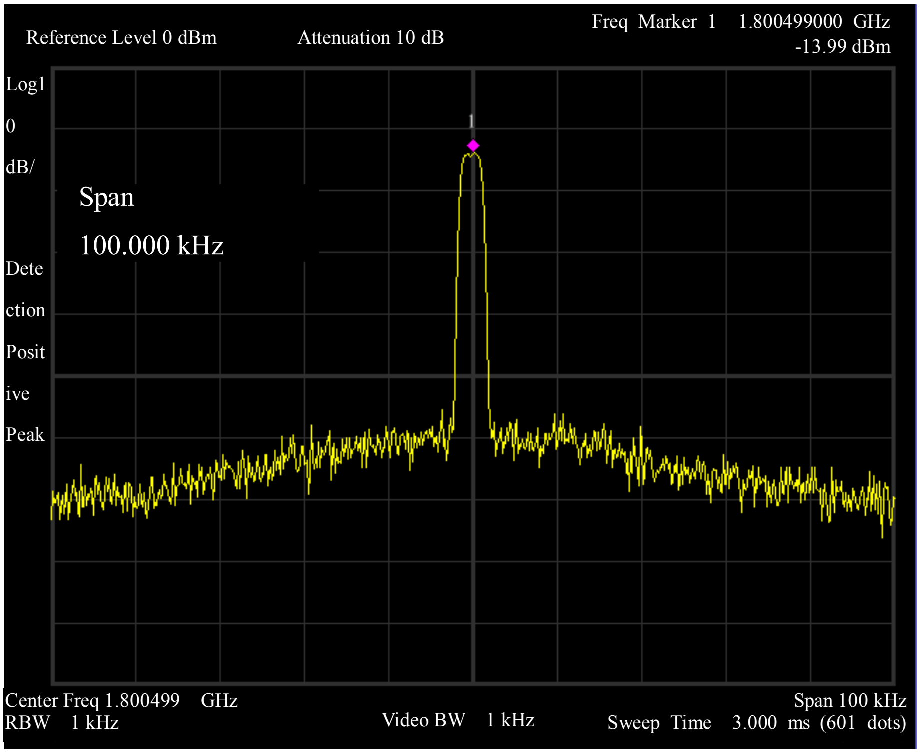


Fig. 3-5 1kHz Signal Space

⑤ Reduce the RBW again to 100Hz.

Press the [BW] key

Press the [RBW Auto Man] key to set the resolution bandwidth to manual and input 100Hz.

Two signals appear on the screen, as shown in Fig. 3-6. Use the knob or [↓] key on the front panel to continuously reduce the resolution bandwidth to see such two signals more clearly.

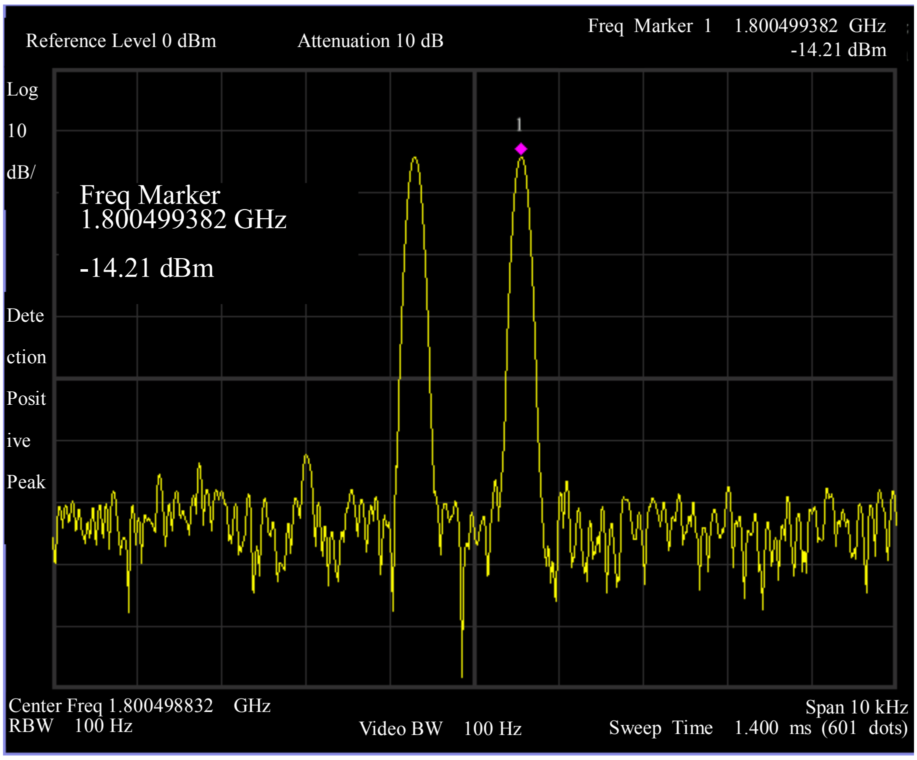


Fig. 3-6 1kHz Signal Space

4 Measuring Steps to Identify Two Signals with Different Amplitudes

This example identifies two signals with different amplitudes, which have the frequency difference of 50kHz and the amplitude variation of around 40dB. In order to identify two signals with different amplitudes, the resolution bandwidth must be lower than the frequency space of two signals (same as the identification of two equi-amplitude signals). However, the identification of the maximum frequency bandwidth for such two signals with different amplitudes mainly depends on the selectivity ratio of IF filter, instead of 3dB bandwidth. The selectivity radio defines the ratio of 60dB bandwidth and 3dB bandwidth of IF filter, as shown in Fig. 3-7.

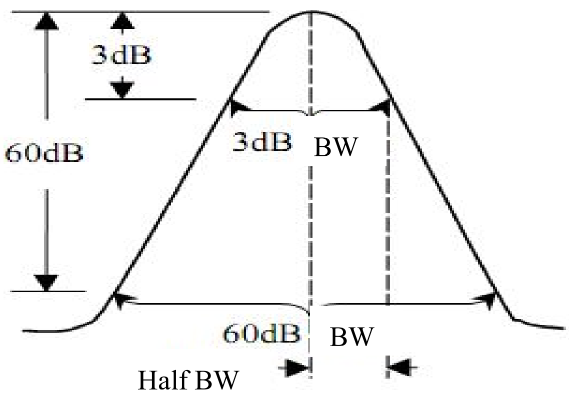


Fig. 3-7 Bandwidth and Selectivity Ratio

1) Connect the RF input port of spectrum analyzer with two signal sources. Set the frequency of one source to 1800MHz with the amplitude of -10dBm, and the frequency of the other source to

1800.05MHz with the signal output amplitude of -50 dBm. Turn on the RF outputs of two signal generators.

2) Set SSA3030 spectrum analyzer:

① Reset the instrument

Press the [Preset] key

② Set the parameters

Press the [Freq] key

Press [Center Freq] key to input 1800.025 MHz

Press the [Span] key

Press [Span] to input 500kHz

Press the [BW] key

Press the [RBW Auto Man] key to set the resolution bandwidth to manual and input 30kHz.

③ Set the 300 MHz signal to reference level

Press the [Peak] key.

Press the [Max Search] to move the marker to the peak frequency.

The selectivity ratio of resolution bandwidth filter in SSA3030 spectrum analyzer is around 5:1. When the resolution bandwidth is 30kHz, the bandwidth at 60dB is 150kHz, so the half bandwidth is 75kHz, higher than the frequency space of 50kHz. Thus, it is impossible to identify such two input signals, as shown in Fig. 3-8.

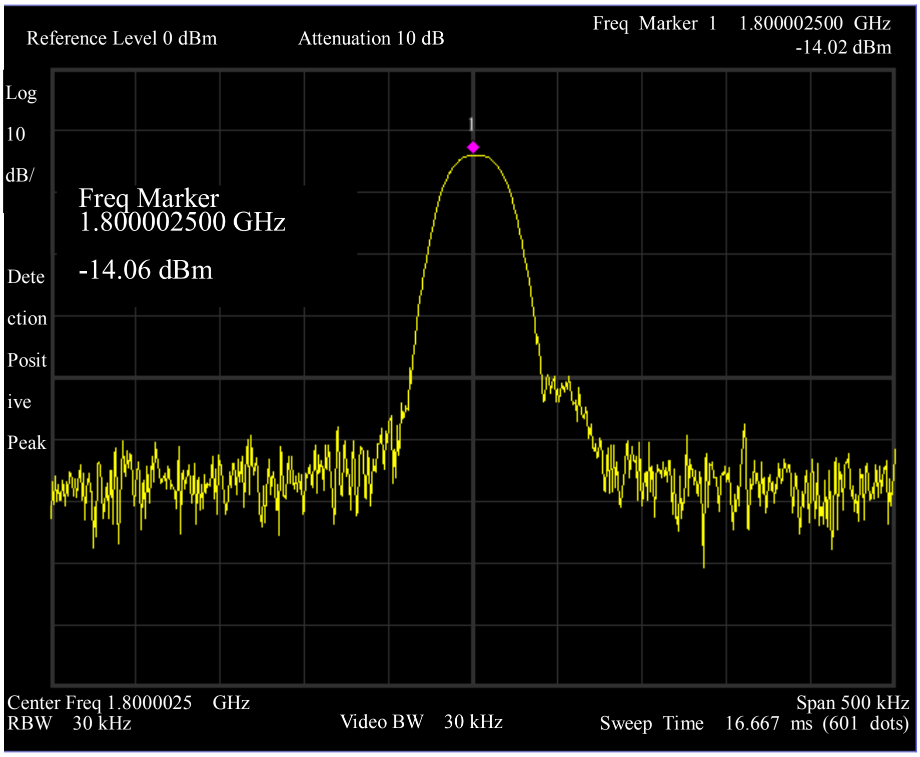


Fig. 3-8 Test at Resolution Bandwidth of 30kHz

④ Reduce the resolution bandwidth to observe the overshadowed smaller signal.

Press the [BW] key

Press the [RBW Auto Man] key to set the resolution bandwidth to manual and input 1kHz.

As shown in Fig. 3-9, the half bandwidth is 2.5kHz, lower than the frequency space of 50kHz, so it is possible to identify two input signals.

⑤ Measure the frequency space of two signals

Press the [Peak] key and [Max Search] to move the marker to the peak frequency;

Press the [Freq Marker] key and [Freq Marker Difference];

Move the marker to the secondary peak to read the frequency difference and amplitude difference of such two signals with different amplitudes, as shown in Fig. 3-9.

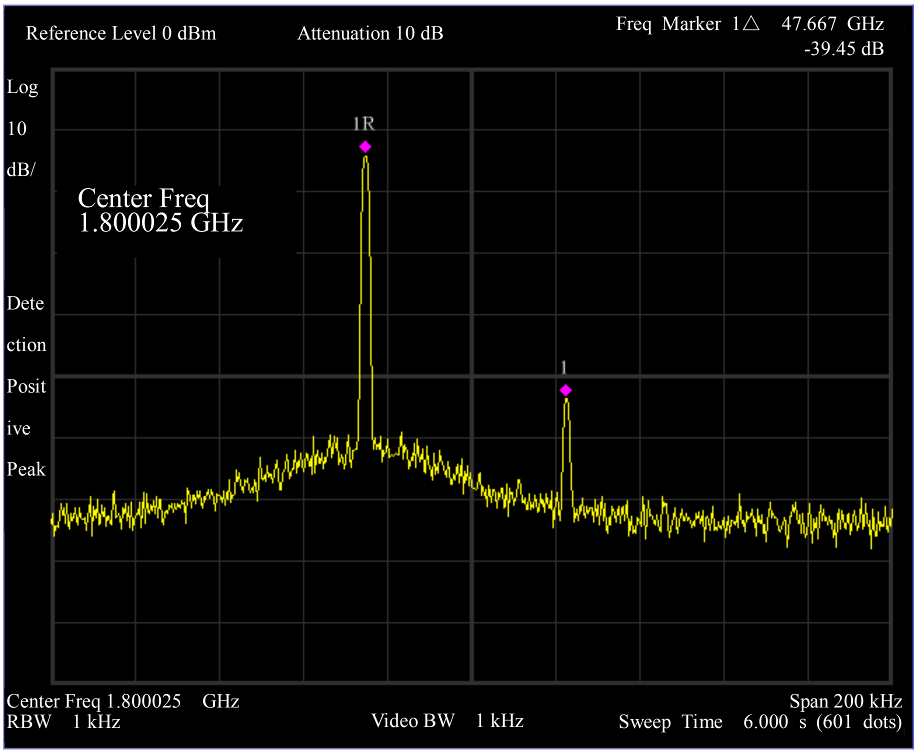


Fig. 3-9 Test at Resolution Bandwidth of 1kHz

Section 4 Measure 3dB Bandwidth

The following example employs the 100MHz and -10dBm nusoidal signal output by signal generator (Agilent E4421B) as its measured signal.

Operating Steps

1. Connect the equipment

Connect the signal output port of signal generator to the RF input port on the front panel of spectrum analyzer.

2. Use the NdB bandwidth to measure the bandwidth of signal

①Reset the instrument

Press [Preset]

② Set the parameters

Press the [Freq] key and the [Center Freq] key to input 100MHz

Press the [Span] key

Press the [Span] key to input 2MHz

③ Use the NdB bandwidth to measure the bandwidth of signal

Press the [Freq Marker Fctn] key

Automatically activate a marker if no marker appears

Press the [N3dB ON OFF] key.

④ Read the measuring results

Press the [Max Search] key to move the marker to the peak frequency.

The measuring results appear in the active function area. When using the resolution bandwidth of 40kHz, the bandwidth for the marker drop of 3dB is 42.5kHz, as shown in the following figure:

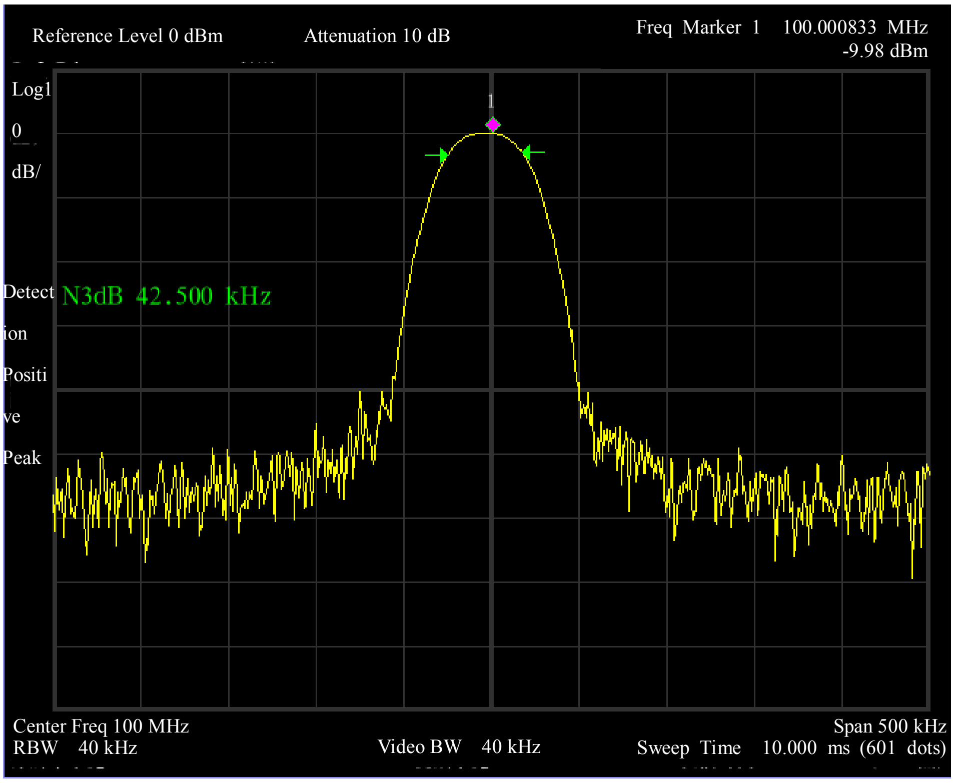


Fig. 3-10 Measuring Results of 3dB Bandwidth

Section 5 Measure Small Signals

1. Reduce the attenuation of RF attenuator to measure small signals

The noise generated inside spectrum analyzer determines its capability of measuring small signals. There are several methods to change the measurement setting in order to improve the

measurement sensitivity of spectrum analyzer. The input attenuator affects the input signal level of the instrument. If the input signal is very close to the background noise, to reduce the attenuation of attenuator can extract the signal from the noise.

Warning: The total power for all input signals of spectrum analyzer must be lower than +33dBm(2W).

a) Reset SSA3030 spectrum analyzer. Press [Preset].
b) Set the signal generator. Its frequency is 445MHz, and its amplitude is -80dBm. Connect the RF output port of signal generator to the RF input port of spectrum analyzer.
c) Set the center frequency, span and reference level of spectrum analyzer.
   Press the [Freq] key, [Center Freq] and 445[MHz]
   Press the [Span] key and 1[MHz]
   Press the [Amplitude] key, [Reference Level] and -40[dBm]
d) Move the signal peak to the center frequency
   Press the [Peak] key, [Max Search] and [Freq Marker→Center Freq]
e) Reduce the span to 100kHz as shown in Fig. 3-11. Repeat the above steps as the case may be, and ensure that the signal peak is at the center frequency of spectrum analyzer.

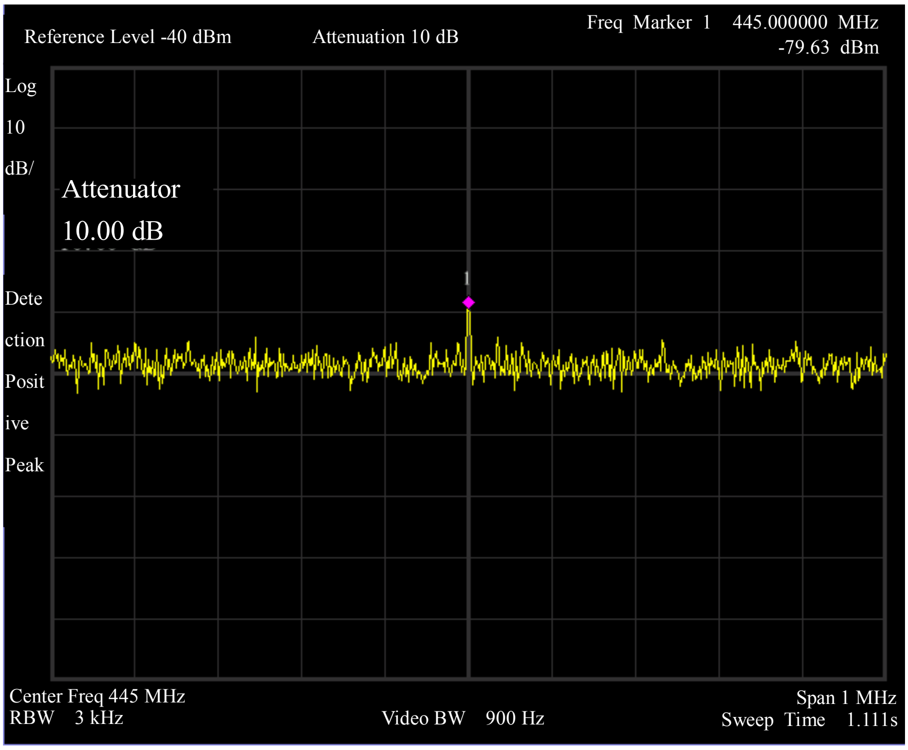


Fig. 3-11 Measurement at Auto Mode of Attenuator

f) Set the attenuation of attenuator to 20dB.
   Press the [Amplitude] key and [Attenuator Auto Man] to select the manual and set the 20[dB].

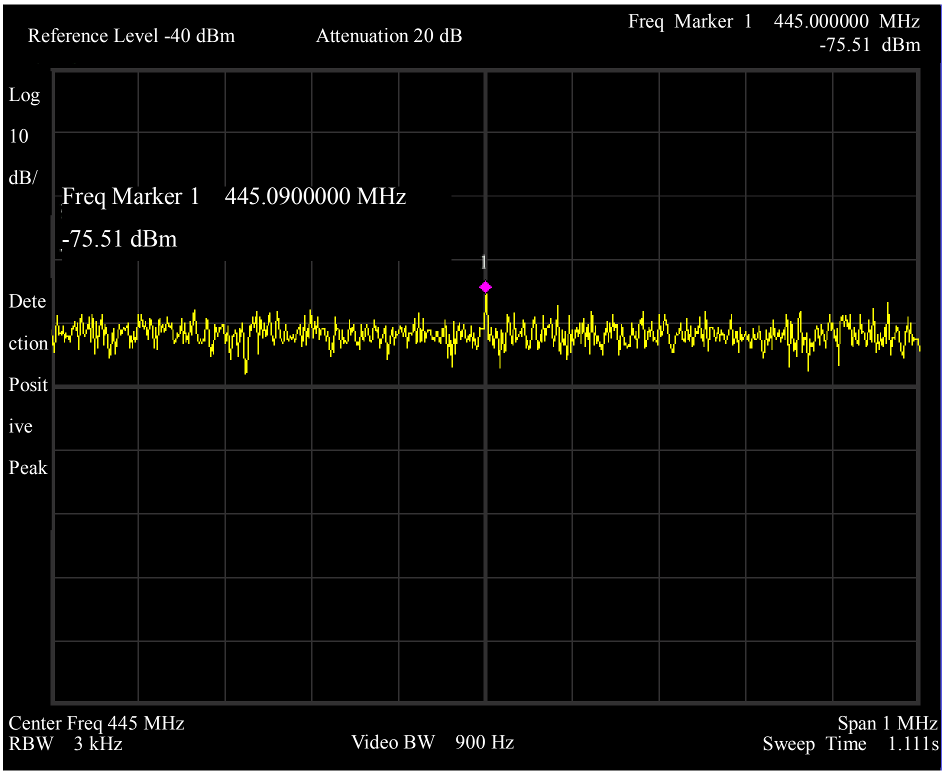


Fig. 3-12 Measurement Mode at Attenuation of 20 dB

As shown in Fig. 3-12, to increase the attenuation of attenuator can increase the background noise, so as to reduce the signal to noise ratio and make the background noise closer to the signal peak. At this time, the error of signal measurement is large.

f) Set the attenuator to 0dB to observe the measured signal more clearly.

Press the [AMPT] key and [Attenuator Auto Man] to 0 dB, as shown in the following figure.

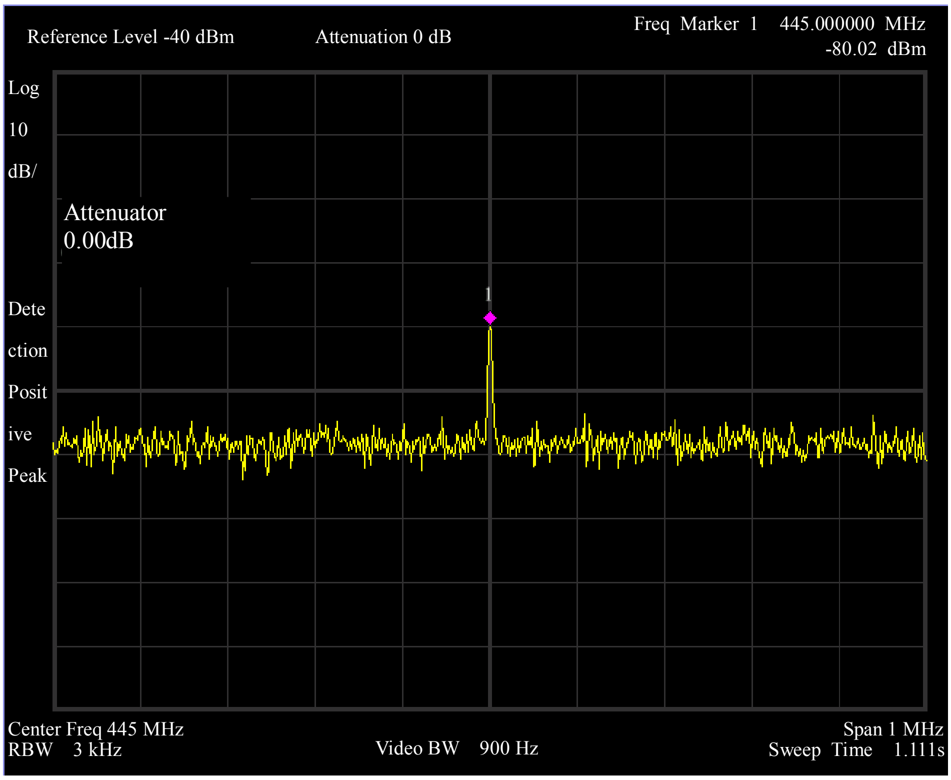


Fig. 3-13 Attenuation Mode of 0dB

2. Reduce resolution bandwidth to measure small signals

The value of resolution bandwidth can affect the background base inside spectrum analyzer, but has no effect on the measured continuous wave signal level, and the low resolution bandwidth is more beneficial to the measurement of small signals.

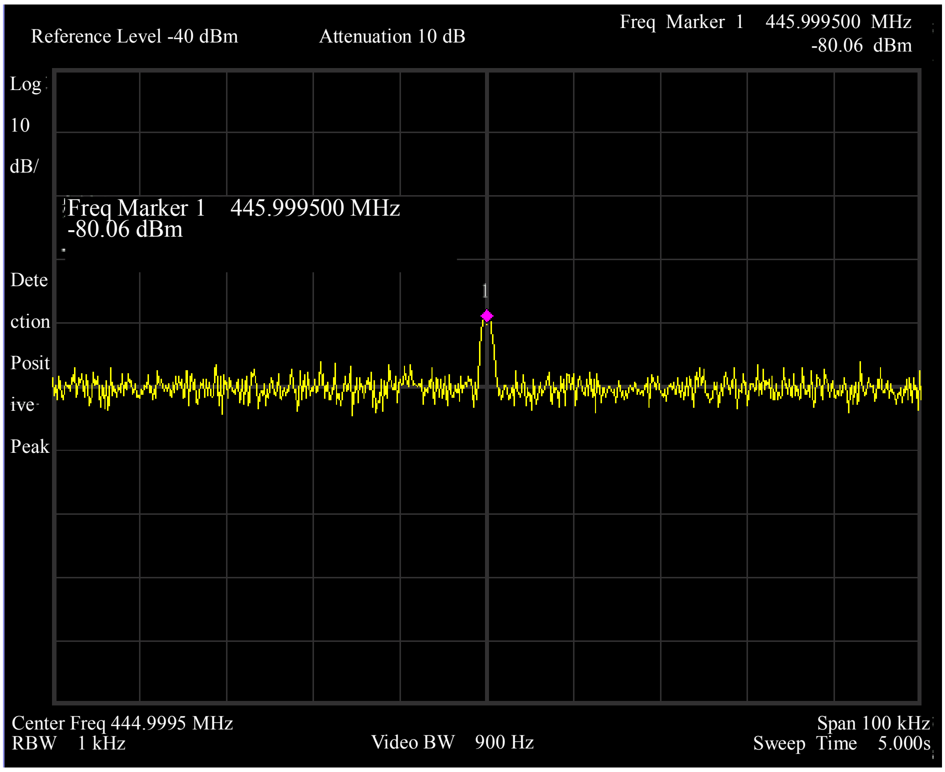


Fig. 3-14 Reduce Resolution Bandwidth to Measure Small Signals

Set the signal source and the parameters of spectrum analyzer as follows:

a) Reset SSA3030 spectrum analyzer. Press the [Preset] key.

b) Set the signal generator. Its frequency is 445MHz, and its amplitude is -80dBm. Connect the RF output port of signal generator to the RF input port of spectrum analyzer.

c) Set the center frequency, span and reference level of spectrum analyzer.

Press the [Freq] key, [Center Freq] and 445[MHz]

Press the [Span] key and 100[kHz]

Press the [Amplitude] key, [Reference Level] and -40[dBm]

Press [BW] and the step key [↓] to reduce the resolution bandwidth till the appropriate value.

As shown in Fig. 3-14, the background noise is reduced, so the signal becomes clear gradually so as to facilitate the measurement observation.

Since the resolution bandwidth is reduced, it may increase the sweep time. For SSA3030 spectrum analyzer, the resolution bandwidth is continuously changed from 5Hz to 500kHz by step, in order to select the appropriate resolution bandwidth and reach a more accurate balance between sweep time and resolution bandwidth.

3. Employ positive peak detection and increase sweep time to measure small signals

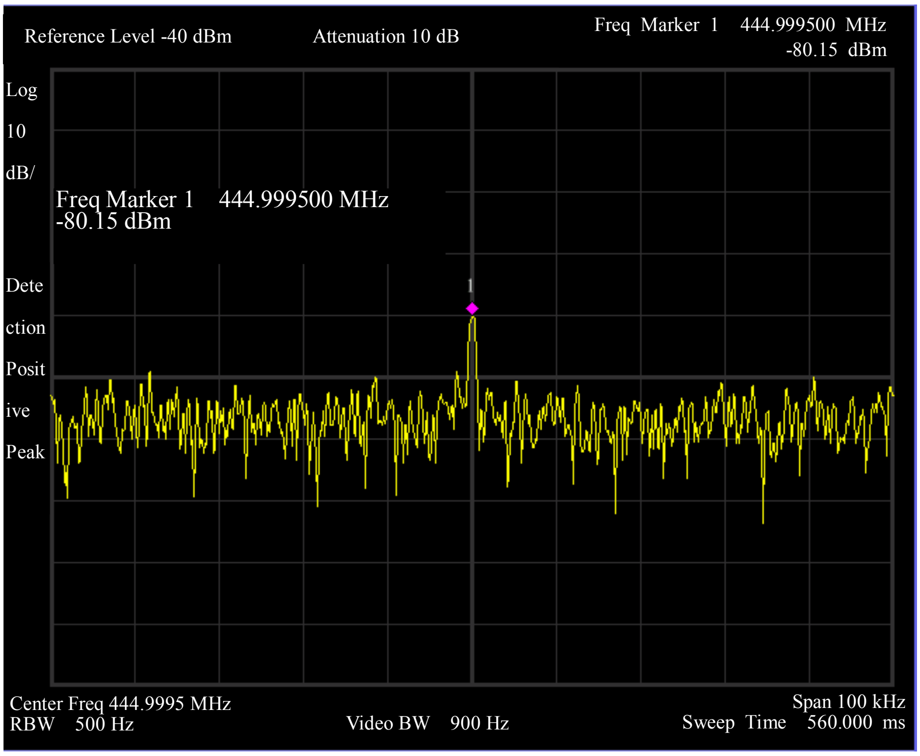


Fig. 3-15 Increase Sweep Time to Measure Small Signals

a) Reset SSA3030 spectrum analyzer. Press the [Preset] key.

b) Set the signal generator. Its frequency is 445MHz, and its amplitude is -80dBm. Connect the RF output port of signal generator to the RF input port of spectrum analyzer.

c) Set the center frequency, span and reference level of spectrum analyzer.

Press the [Freq] key, [Center Freq] and 445[MHz]

Press the [Span] key and 100[kHz]

Press the [Amplitude] key, [Reference Level] and -40[dBm]

d) Select the detection positive peak as the detection mode of spectrum analyzer.
   Press [Trace], [Next Page], [Detection Mode►], [Positive Peak]
   At this time, “Detection Positive Peak” appears in the left middle of the display screen, which means that the detection mode is manually set to the positive peak detection.
e) Increase the sweep time of spectrum analyzer
   Press the [BW] key, [Sweep Time Auto Man], and increase the sweep time with the step key to 3.00s.
   As shown in Fig. 3-15, the increased sweep time gives more time to average the data at each trace pixel dot.

4 Use the trace average to measure small signals

Trace average means to employ the digital processing method to average the currently swept trace points and the past averages at the same trace positions.

a) Reset SSA3030 spectrum analyzer. Press the [Preset] key.
b) Set the signal generator. Its frequency is 445MHz, and its amplitude is -80dBm. Connect the RF output port of signal generator to the RF input port of spectrum analyzer.
c) Set the center frequency, span and reference level of spectrum analyzer.
   Press the [Freq] key, [Center Freq] and 445[MHz]
   Press the [Span] key and 100[kHz]
   Press the [Amplitude] key, [Reference Level] and -40[dBm]
d) Select the detection positive peak as the detection mode of spectrum analyzer.
   Press [Trace], [Next Page], [Detection Mode►], [Positive Peak]
e) Activate the function of trace average. Press the [BW] key, [Trace Avg ON OFF], and set the average times to 20.

As the averaging program averages the trace, the small signal becomes clearer and clearer. After activating the averaging function, the default average times is 100 times, as shown in Fig. 3-16.

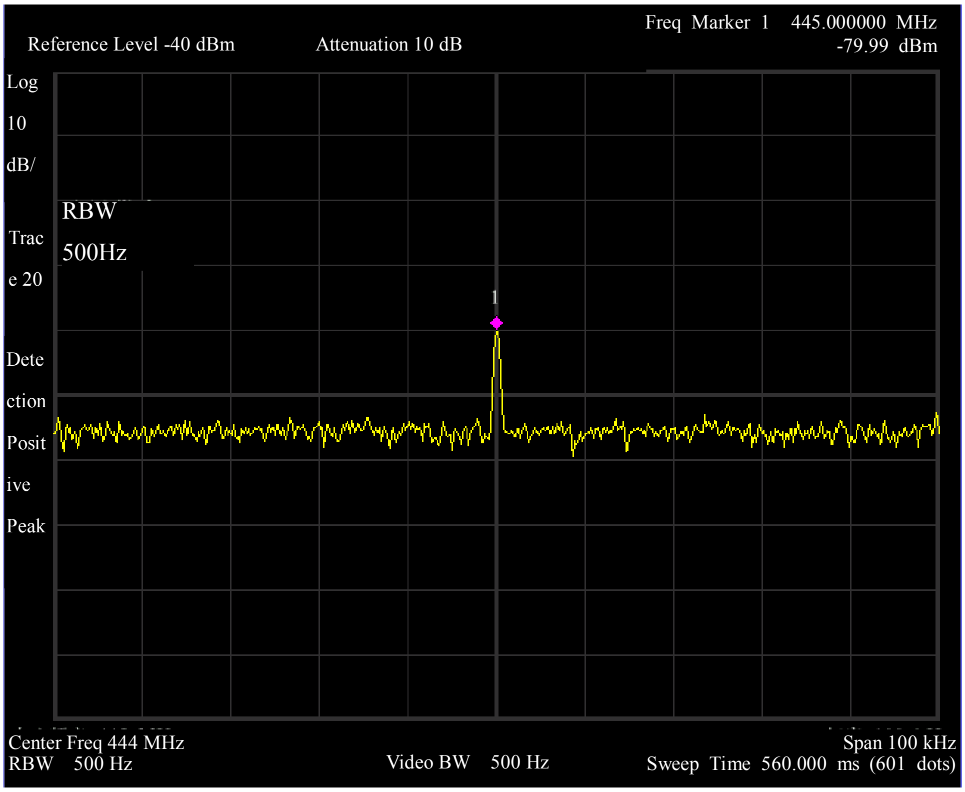


Fig. 3-16 Activate Trace Average to Measure Small Signals

Section 6 Measure Harmonic Distortion

1 Definition of harmonic distortion

Most of transmission devices and signal sources contain harmonics that are often required to be measured. In fact, the measurement of harmonic distortion is one of the widest applications of spectrum analyzer. The measuring procedure described hereunder can be employed to rapidly measure the harmonic distortion. The measuring procedure can measure the correlation between harmonic amplitude and signal source frequency.

2 Function of spectrum analyzer to be used

For the measurement of harmonic distortion, a group of important operating skills of spectrum analyzer are presented hereunder, including setting the sweep width by means of start frequency and stop frequency, setting the video bandwidth, and using two frequency markers for relative measurement. Meanwhile, the section also demonstrates how to use the frequency markers to set the signal frequency as the center frequency and set the value of center frequency as the frequency step.

3 Measuring method of harmonics

There are two common methods to measure the harmonic distortion with spectrum analyzer. Method A is a quick one and can display the fundamental wave and its harmonics at the same time. Method B needs a long time of measurement, but it can well measure the harmonic signals close to the background noise.

■Method A Quick Harmonic Measuring Method:
This example measures the harmonics in the 2MHz signal generated by signal generator. The start frequency and stop frequency of spectrum analyzer are adjusted to the frequency of the signal and its harmonics.
Measure 2MHz fundamental wave signal and its second and third harmonic signals.
a) Connect the output of signal source with the RF input port of spectrum analyzer.
b) Press the [Preset] key to reset the spectrum analyzer.
c) Press the [Freq] key to set [Start Freq] to 1.5MHz and [Stop Freq] to 7MHz.
As shown in Fig. 3-17, the fundamental wave and its second and third harmonics are displayed on the screen.

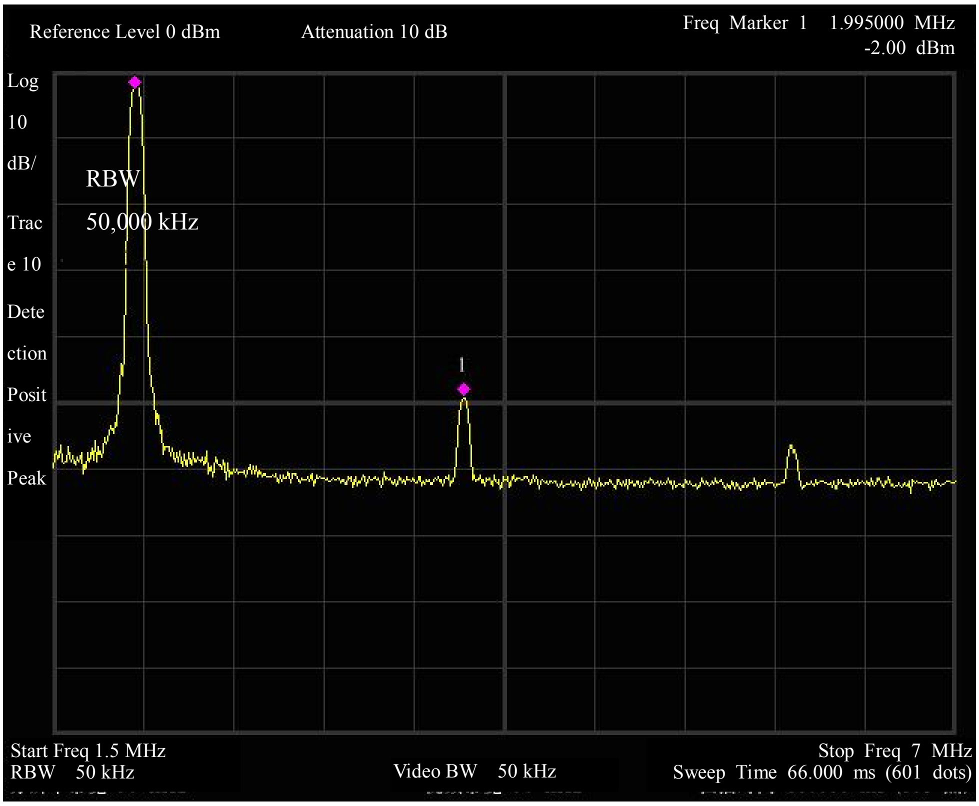


Fig. 3-17 Fundamental Wave and Harmonics Measurement of Measured Signal

4) Set the trace average to smooth the noise and improve the resolution:
   a) Press the [BW] key, [Trace Avg ON OFF] to 10, [Enter]
   b) Press the step key [↓] to select the video bandwidth to an appropriate value.

5) Mark the second harmonic with the second frequency marker.

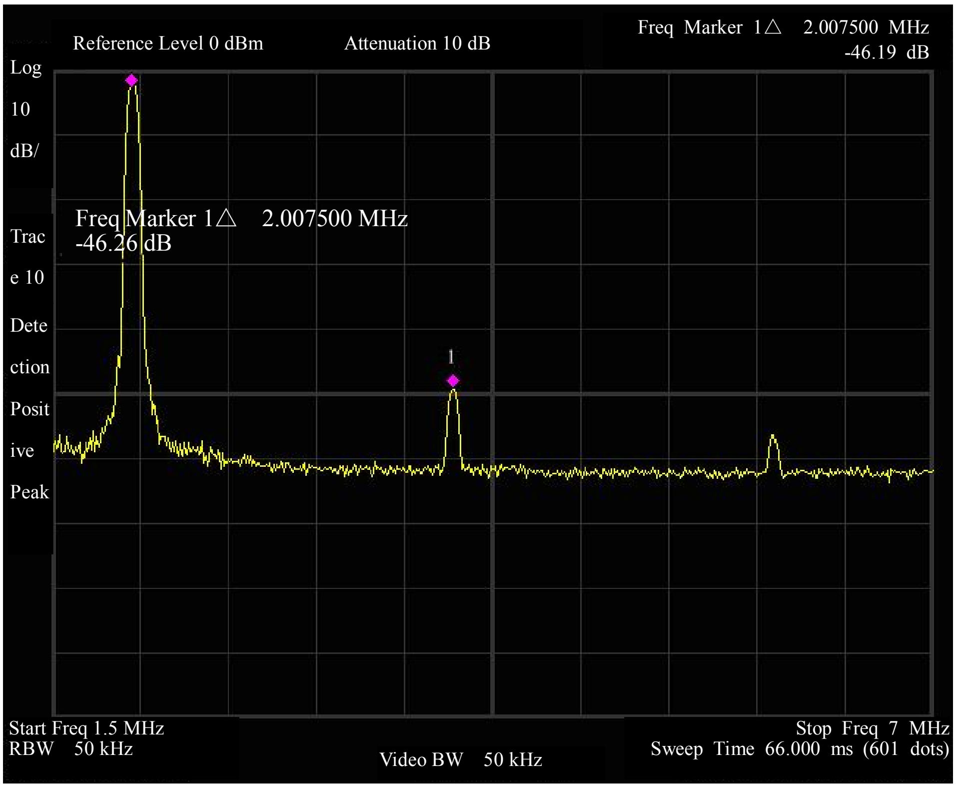


Fig. 3-18 Harmonic Distortion in dB

Activate the second frequency marker:

a) Press [Peak]

b) Press [Freq Marker], [Freq Marker Difference]

c) Move the marker to the second harmonic peak.

At this time, fix the frequency marker at the fundamental wave and the second frequency marker at the peak of second harmonic. Read the measuring results as shown in Fig. 3-18.

■Method B Harmonic Measuring Method:

This method has a few more steps, but it improves the signal to noise ratio and obtaines more accurate measuring results since each signal is measured at the low sweep width and resolution bandwidth.

Measure the 2MHz fundamental wave signal. The results are shown in Fig. 3-19.

1. Press [Freq Marker], [All Off] at the current settings to eliminate the frequency marker on the screen.

2. Reduce the sweep width:

a) Press the [Freq] key to set the center frequency to 2MHz.

b) Press the [Peak] key to activate the frequency marker to search for the signal peak.

c) Press the [Sweep Width] key to reduce the sweep width to 50kHz.

d) Press the [BW] key to reduce the resolution bandwidth to 800Hz.

3. Set the step of center frequency to the fundamental wave signal frequency: press [Freq Marker→], [Freq Marker→Freq Step].

4. Move the signal peak to the top line to obtain the best amplitude measurement accuracy: press [Freq Marker→Reference Level].

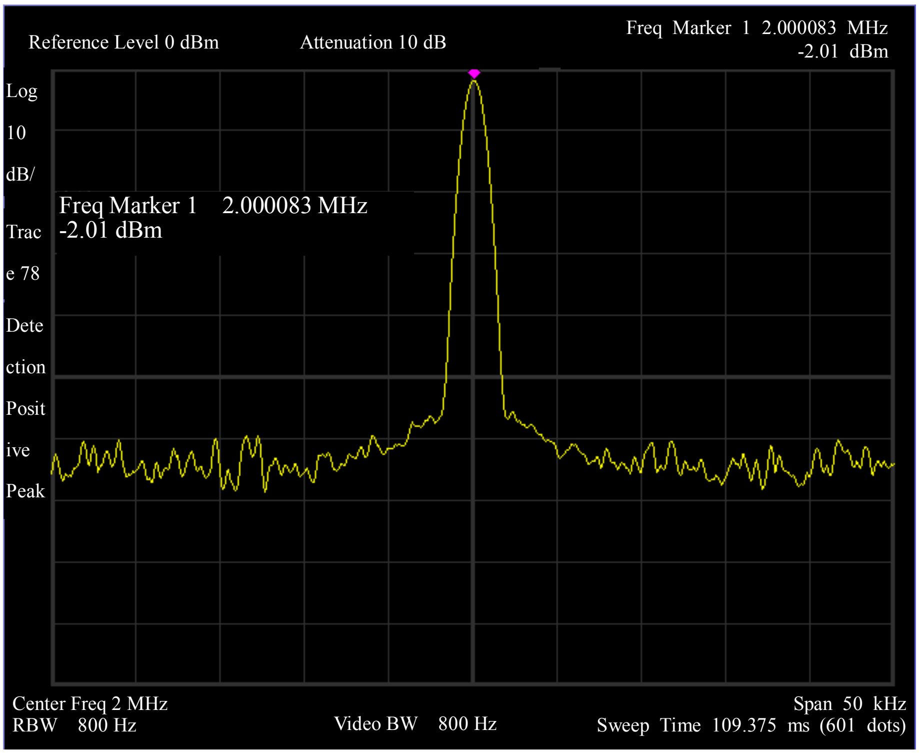


Fig. 3-19 Input Signal at Sweep Width of 50kHz

5. Measure the second harmonic as shown in Fig. 3-20.

6. Press [Freq Marker], [Freq Marker Difference], [Freq] and step key [↑]. Move the center frequency of spectrum analyzer to the second harmonic by stepping.

7. Adjust the harmonic peak to the reference level (Note: the [Freq Marker→Reference Level] function to the mode of freq marker difference is invalid).

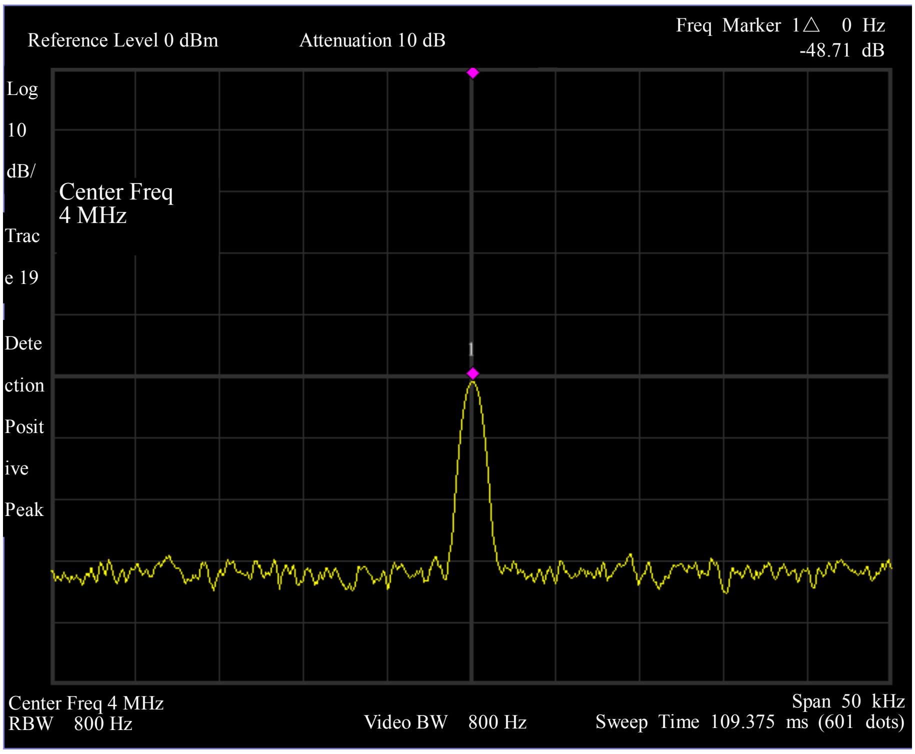


Fig. 3-20 2MHz Second Harmonic

8. If any other harmonics must be measured, press the step key [↑] of spectrum analyzer and adjust the reference level. Note: The arrow at the left upper corner of lattice indicates that the fixed frequency marker deviates from the screen, but the results are still valid.

Section 7 Measurement of Three-order Intermodulation Distortion

1 Definition of three-order intermodulation distortion (IMD)

In the environment of crowded communications system, the mutual interference among equipments is a very common problem. For instance, it is often to run into the problem of two-order or three-order IMD in the narrow band system. When a system has two signals (F1 and F2), their products—second harmonic distortion signals (2F1 and 2F2) are mixed to generate the three-order IMDs 2F2－F1 and 2F1－F2, which are very close to the original signals. Moreover, the high-order IMD may also happen. All these distortion products are caused by the amplifier and mixer, etc. in the system.

2 Function of spectrum analyzer to be used

This section describes how to measure the three-order IMD. It will present how to display two signals on the screen of spectrum analyzer at the same time and set the resolution bandwidth, mixer level and reference level. Moreover, some frequency marker functions are also employed.

3 Measuring steps

Connect the measuring system

(1) Connect the measured device with spectrum analyzer as shown in Fig. 3-18. This example

employs a power combiner and two signal sources, 445MHz and 446MHz. The frequencies of these signal sources may be different. However, the frequency space in this example must be kept around 1MHz. The measured device is a 26dB preamplifier. The low pass filter is used to filter the harmonics from signal sources, and prevent the reflected signals from causing the distortion of signal sources.

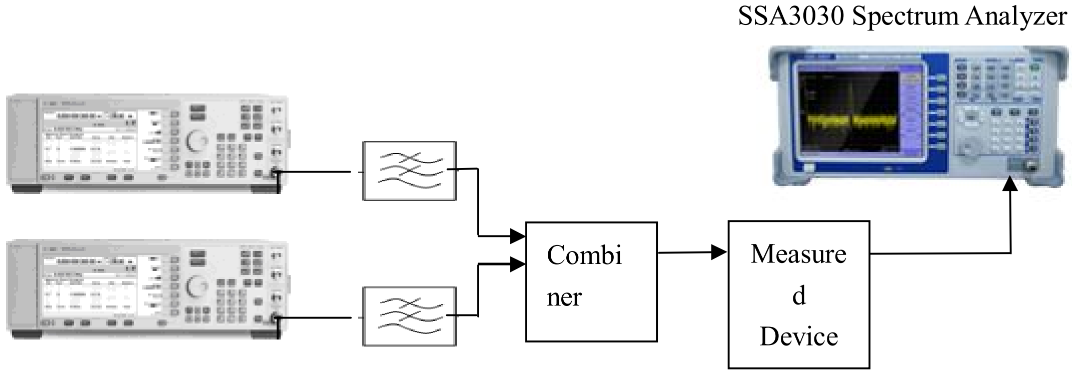


Fig. 3-21 Connection of Three-order IMD Measurement

(2) Set the frequency of one source to 445MHz and the frequency of the other source to 446MHz, and ensure that the frequency difference is 1MHz.

(3) Set the same output amplitude of signal sources (0dBm in this example).

Reduce the sweep width

(4) Press [Freq], [Center Freq]

Set the center frequency of spectrum analyzer to 445.5MHz to make two signals appear on the screen of spectrum analyzer at the same time.

(5) Press [Span], [Sweep Width]

Reduce the sweep width to 10MHz, and make the span on the screen sufficient to cover the distortion products. If the employed frequency space is different from that in this example, it is necessary to select the sweep width three times larger than the frequency space of signal sources.

Set the center frequency and adjust the display of signals on the screen

(6) Press the [Freq] key;

(7) Move two signals to the center of screen with knob, as shown in Fig. 3-22.

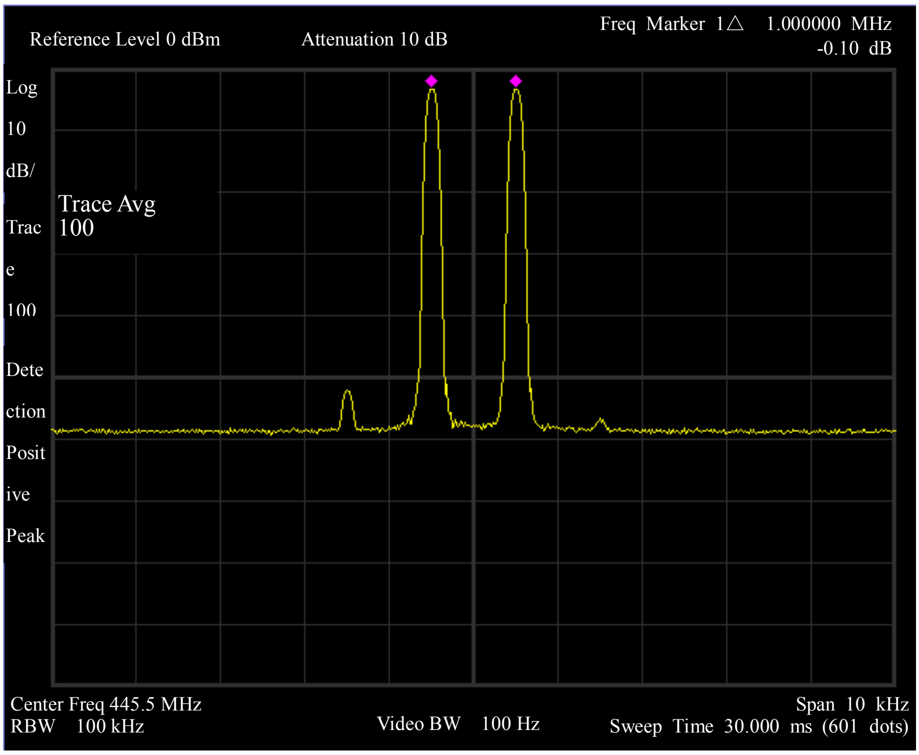


Fig. 3-22 Move Signals to the Center of Display of Spectrum Analyzer

(8) In order to identify the distortion products, reduce the resolution bandwidth till they can be seen:

a. Press [BW].

b. Use the step key [↓] to reduce the resolution bandwidth.

(9) Reduce the video bandwidth if necessary.

(10) Confirm that the input signals have the same amplitude:

a. Press [Peak], [Freq Marker], [Freq Marker Differential] to move the marker to the second peak.

b. Adjust the corresponding signal sources of the frequency marker till the amplitude difference is zero.

Set the reference level

(11) In order to obtain the best measurement accuracy, it is necessary to place the peak of source signal at the reference level. The function [Freq Marker→Reference Level] of spectrum analyzer makes it possible to employ the frequency marker to set the reference level:

a. Press [Peak] to place the frequency marker at the peak of source signal.

b. Press [Freq Marker→], [Freq Marker→Reference Level] to set the reference level.

Set the second frequency marker to measure the distortion products

(12) Once the frequency marker is activated, the frequency marker difference function can generate the second frequency marker and display the difference between two frequency markers. At that time, it is very convenient to perform the relative measurement.

(13) Measure the distortion products:

a. Press the [Peak] key to set a frequency marker at the source signal.

b. Press [Freq Marker], [Freq Marker Difference] to activate the second frequency marker.

c. Move the marker to the peak of distortion products, so as to read the measuring results.

As shown in Fig. 3-23, two frequencies and amplitude difference are displayed in the frequency marker display area. The amplitude difference of frequency markers is the measured value of three-order IMD.

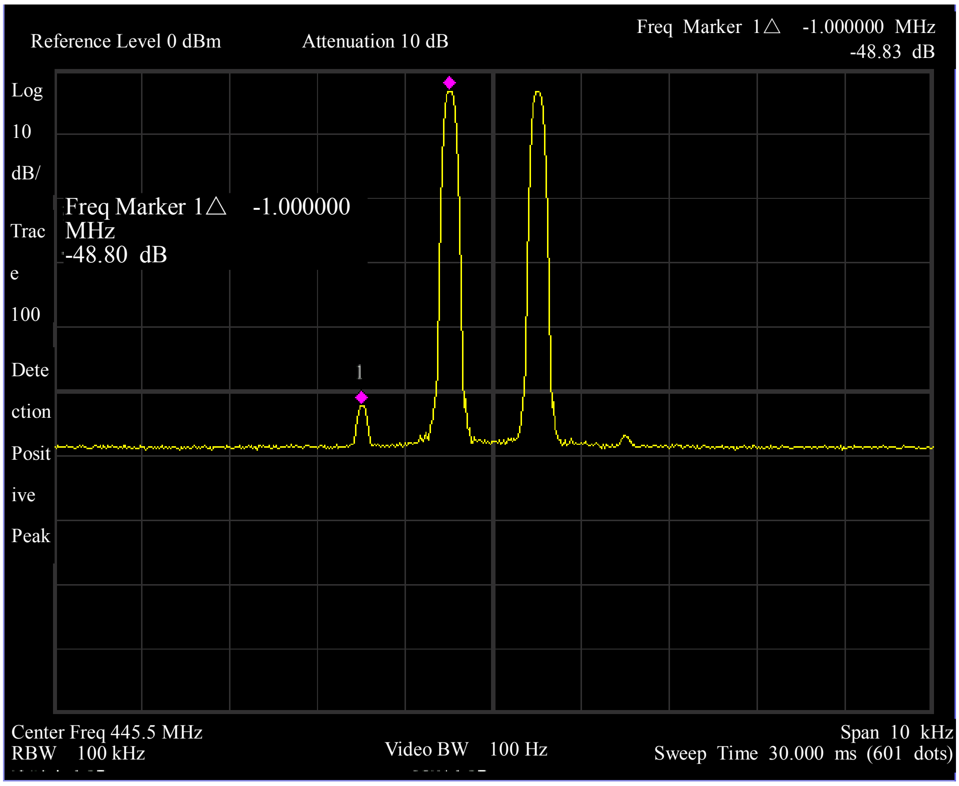


Fig. 3-23 Relative Measurement of Internal Distortion Signal

Section 8 Measurement of AM Modulation Signals

The zero span function of SSA3030 radio frequency spectrum analyzer is adopted to demodulate the AM modulation signal from the carrier signal, and display it on the screen. This example employs an AM modulation signal output by signal generator (e.g. E4421B) as the measured signal. Its carrier is 100MHz,-10dBm nusoidal signal. The modulation frequency is 1kHz and the modulation depth is 100% demodulation.

Measurement at zero span

Operating Steps

1. Connect the equipment

Connect the signal output port of signal generator to the RF input port on the panel of spectrum analyzer.

2. Use the zero span to measure AM signal

①Reset the instrument

Press [Preset]

② Set the parameters

Press the [Freq] key, [Center Freq] and 100MHz;

Press the [Span] key, [Zero Span] to set the span of spectrum analyzer to 0 Hz;

Press the [Span] key, [Sweep Time Auto Man] to switch to "Auto" and input 10ms;

Make use of the marker to measure the frequency of AM modulation signal.

Press the [Sweep Single] key

Press the [Peak] key

Press the [Freq Marker] key, [Freq Marker Difference]

Press the [Peak], [Left Peak] or [Right Peak] key to search for the right or left peak.

Read the frequency difference between two neighboring waveform peaks, which is the frequency of modulation signal.

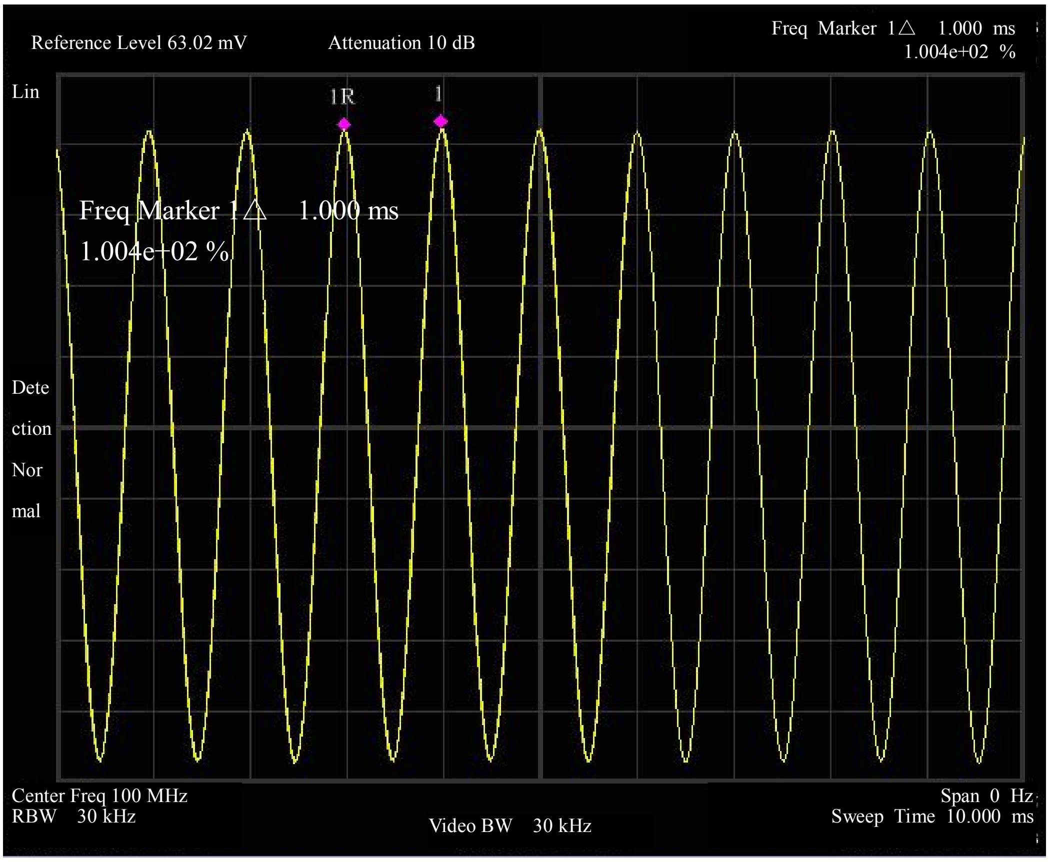
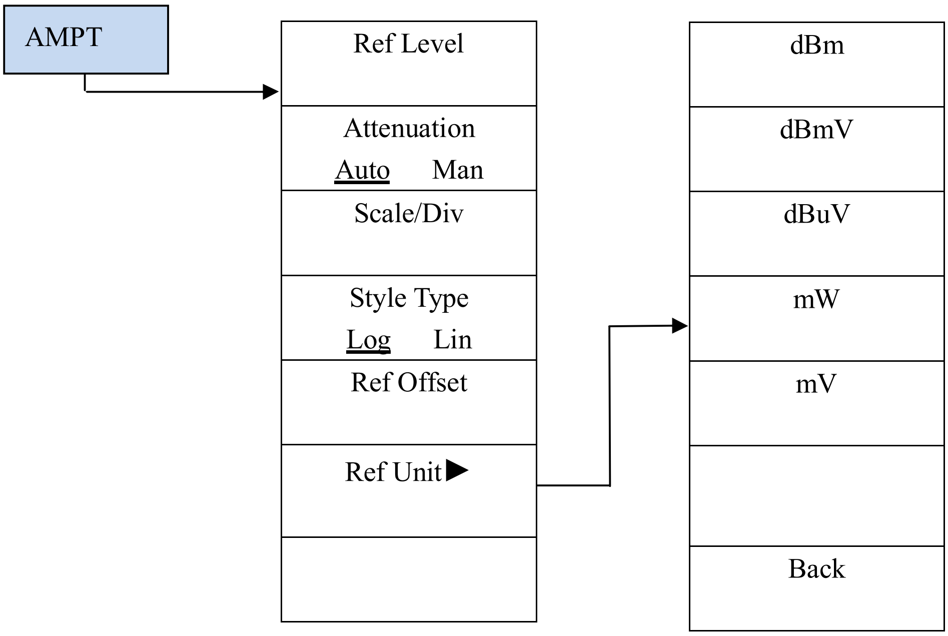


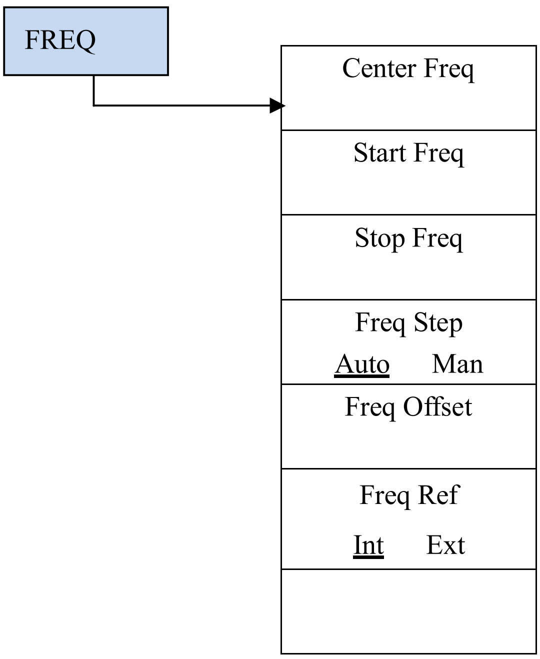
Fig. 3-24 AM Demodulation Results at Zero Span

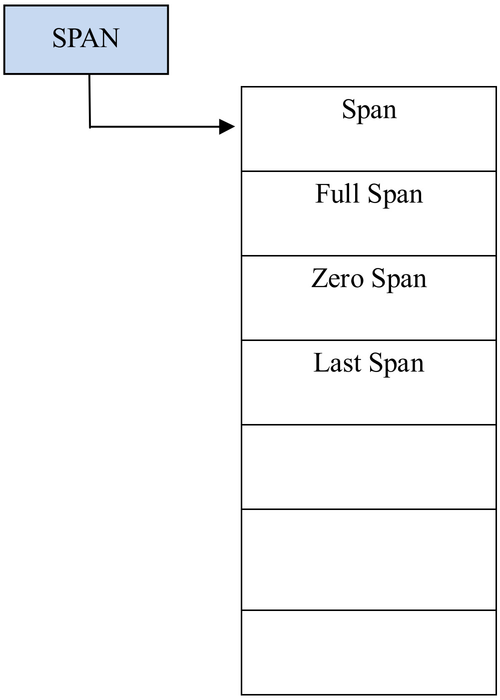
3. Read the measuring results. The measured frequency of modulation signal is 1kHz, as shown in Fig. 3-24.

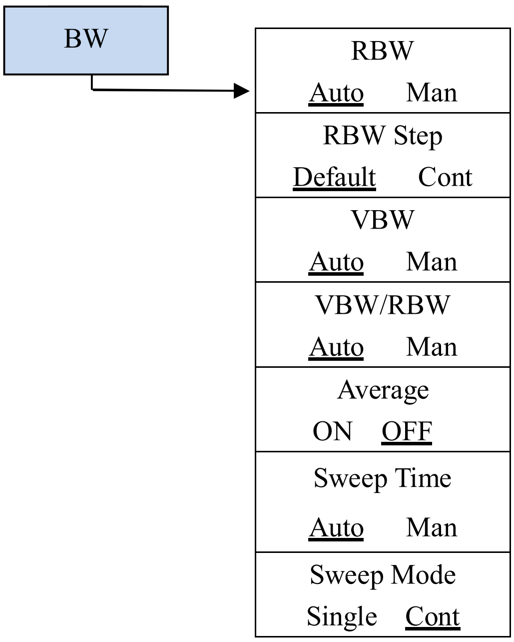
Chapter IV Menu Description

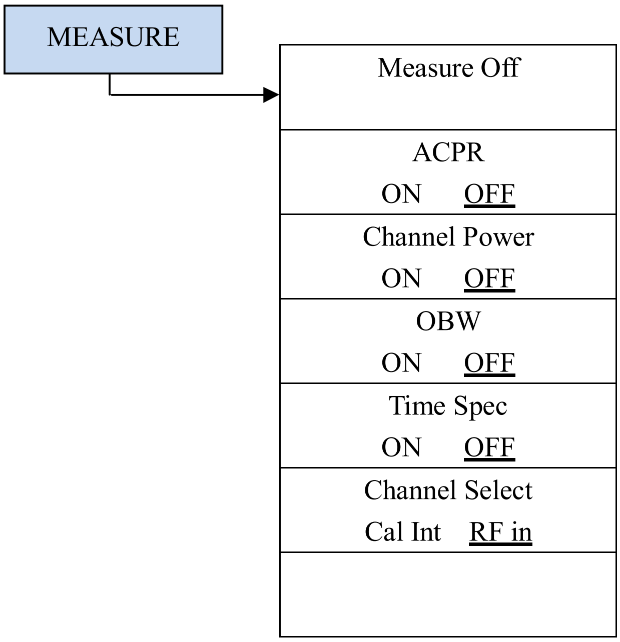
Section 1 Menu Structure

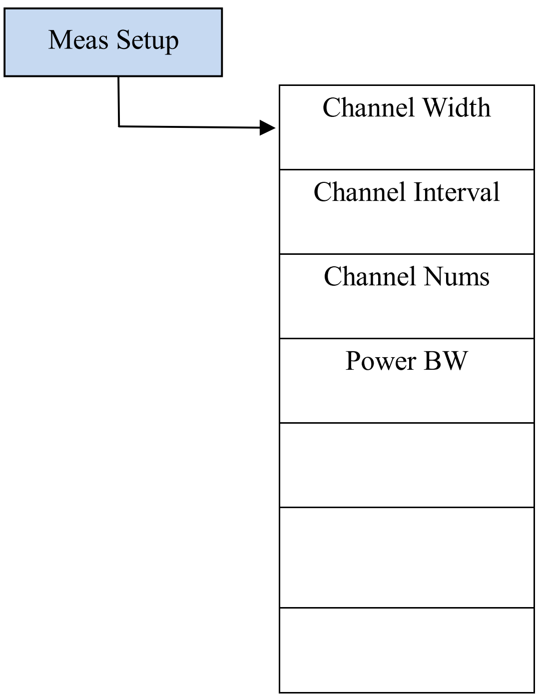


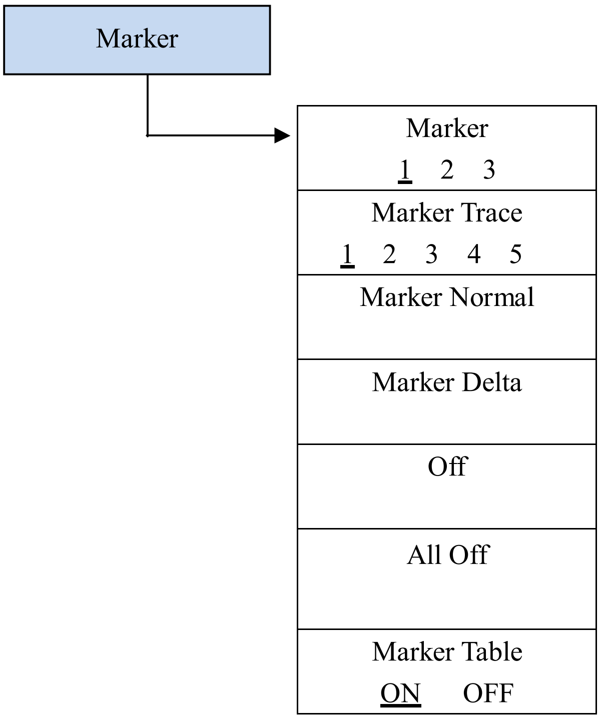


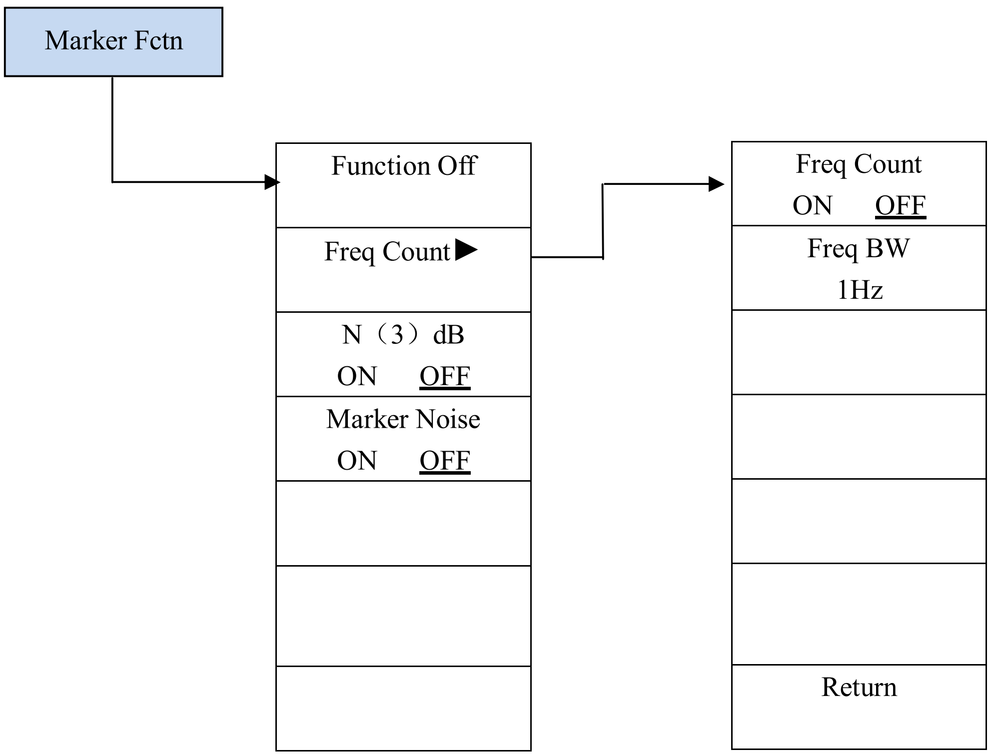

SPAN
Span
Full Span
Zero Span
Last Span


BW
RBW
Auto Man
RBW Step
Default Cont
VBW
Auto Man
VBW/RBW
Auto Man
Average
ON OFF
Sweep Time
Auto Man
Sweep Mode
Single Cont


MEASURE
Measure Off
ACPR
ON OFF
Channel Power
ON OFF
OBW
ON OFF
Time Spec
ON OFF
Channel Select
Cal Int RF in


Meas Setup
Channel Width
Channel Interval
Channel Nums
Power BW


Marker
Marker
1 2 3
Marker Trace
1 2 3 4 5
Marker Normal
Marker Delta
Off
All Off
Marker Table
ON OFF

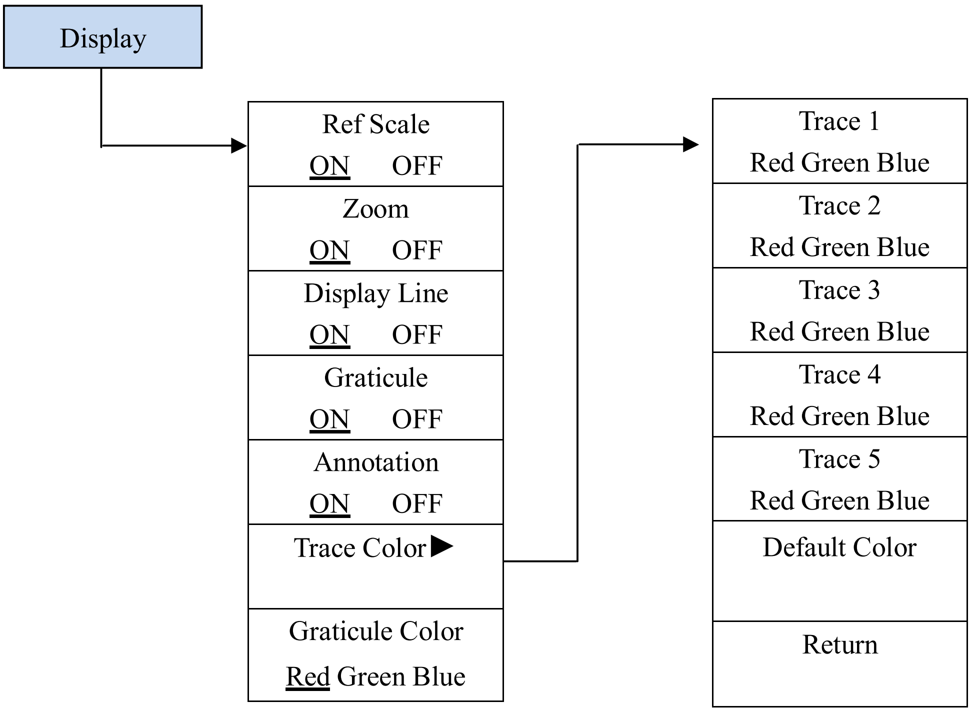

Marker Fctn
Function Off
Freq Count ▶
N（3）dB
ON OFF
Marker Noise
ON OFF
Freq Count
ON OFF
Freq BW
1Hz
Return

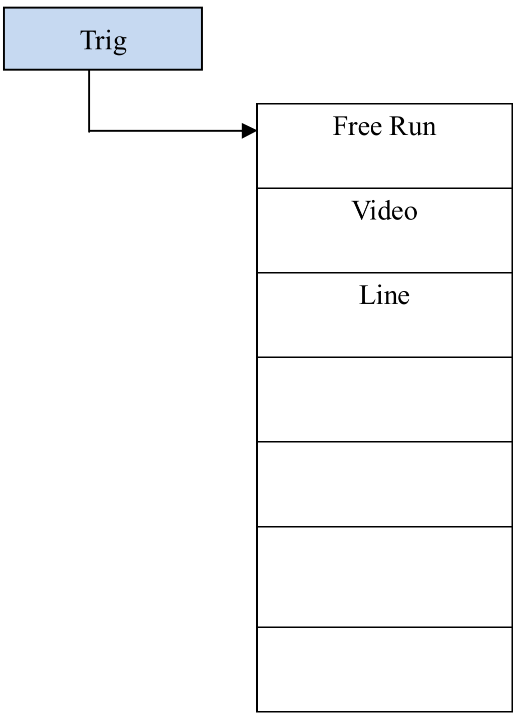
Marker →

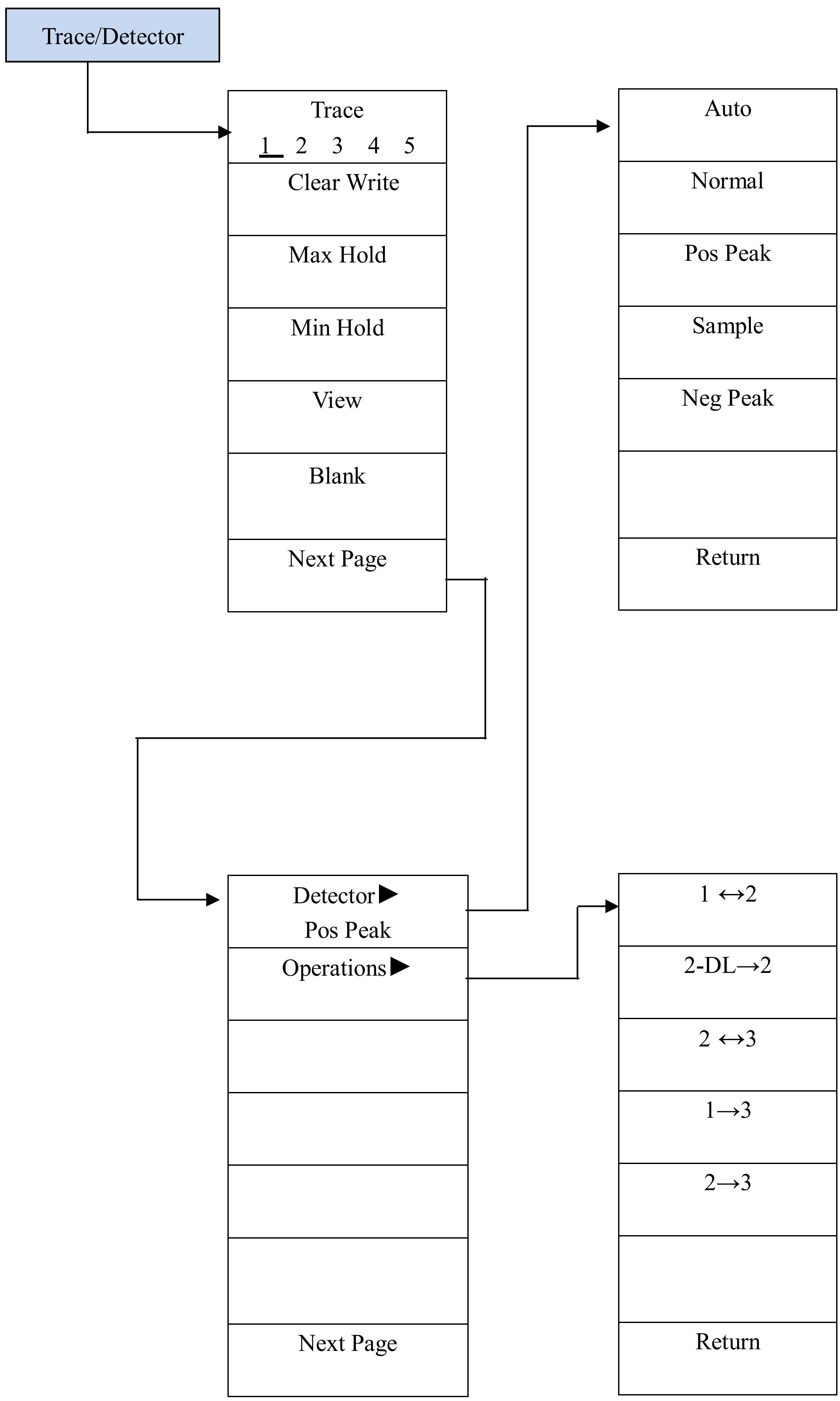
- Mkr→CF
- Mkr →CF Step
- Mkr →Start
- Mkr→Stop
- Mkr →Ref Lvl
- Mkr ∆→Span
- Mkr∆→CF

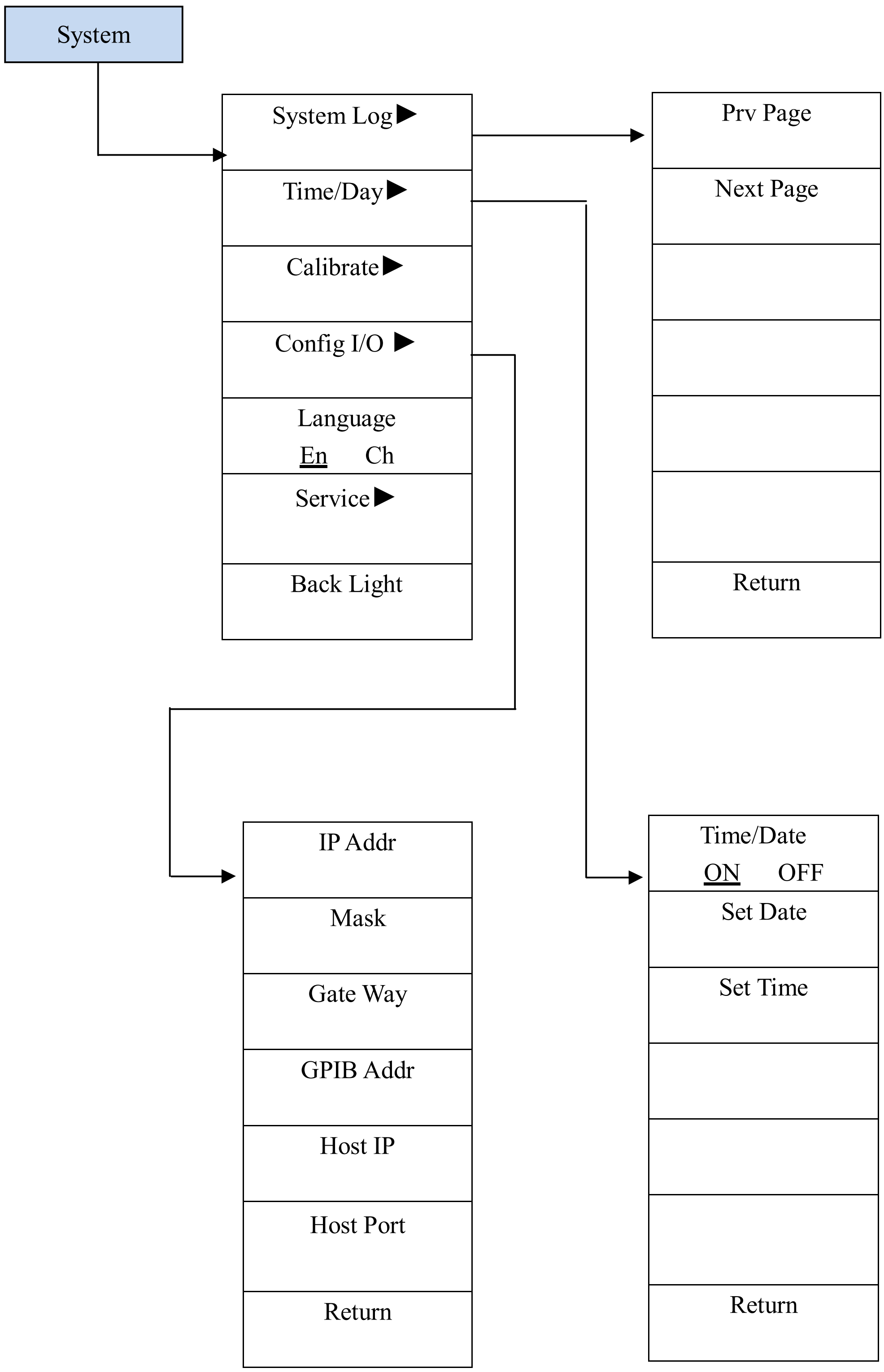
Peak

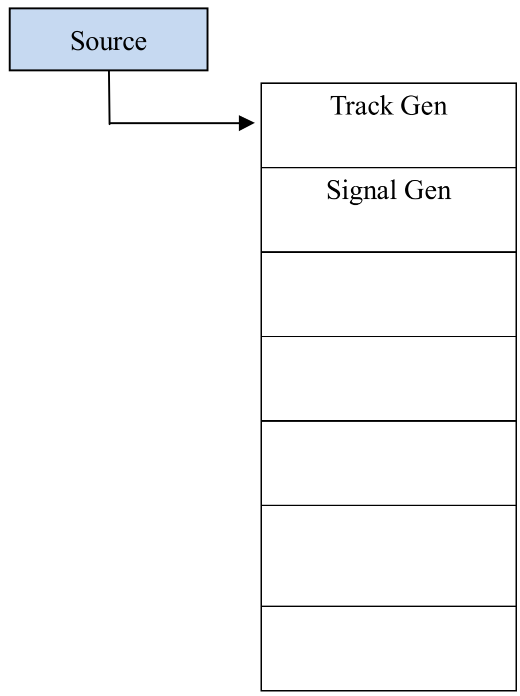
- Max Search
- Next Peak
- Left Peak
- Right Peak
- Min Search
- Peak→CF
- Peak Mode <u>Auto</u> Man

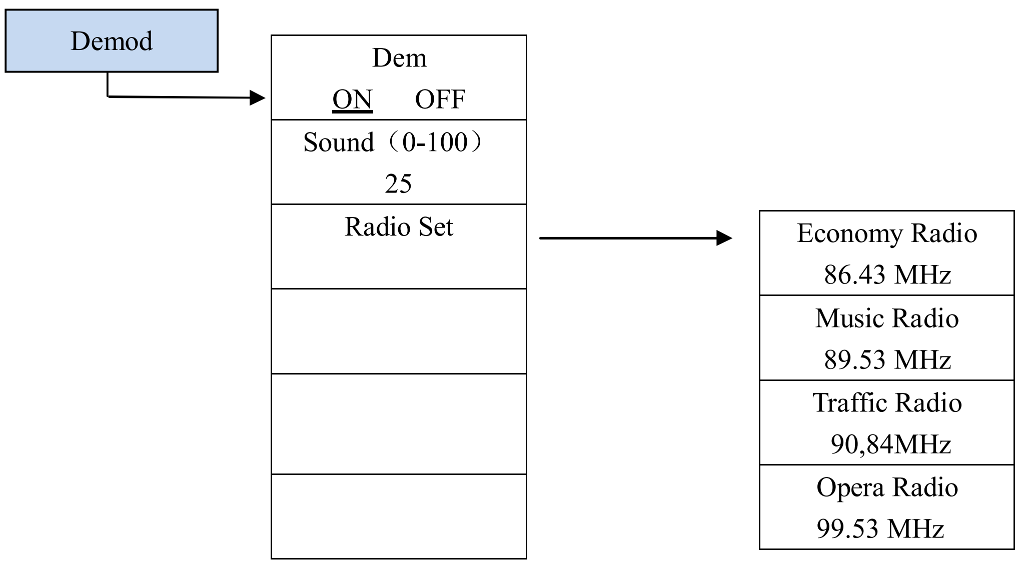

Display
Ref Scale
ON OFF
Zoom
ON OFF
Display Line
ON OFF
Graticule
ON OFF
Annotation
ON OFF
Trace Color ▶
Graticule Color
Red Green Blue
Trace 1
Red Green Blue
Trace 2
Red Green Blue
Trace 3
Red Green Blue
Trace 4
Red Green Blue
Trace 5
Red Green Blue
Default Color
Return

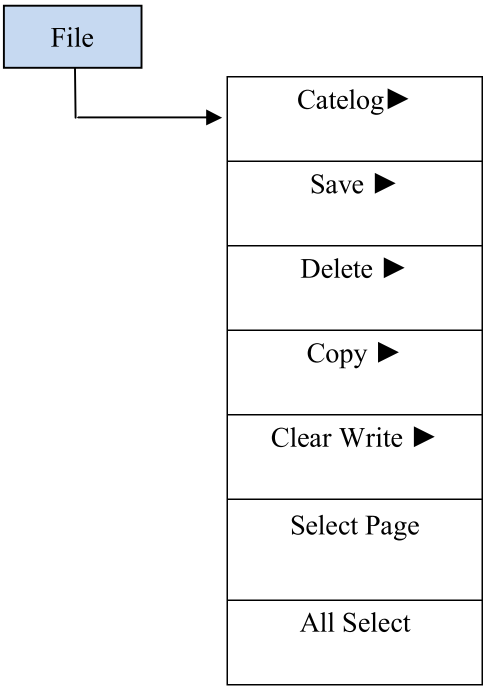

Trig
Free Run
Video
Line


Trace/Detector
Trace
1 2 3 4 5
Clear Write
Max Hold
Min Hold
View
Blank
Next Page
Auto
Normal
Pos Peak
Sample
Neg Peak
Return
Detector▶
Pos Peak
Operations▶
Next Page
1 ↔2
2-DL→2
2 ↔3
1→3
2→3
Return


System
System Log
Time/Day
Calibrate
Config I/O
Language
En Ch
Service
Back Light
Prv Page
Next Page
Return
IP Addr
Mask
Gate Way
GPIB Addr
Host IP
Host Port
Return
Time/Date
ON OFF
Set Date
Set Time
Return


Source
Track Gen
Signal Gen


Demod
Dem
ON OFF
Sound（0-100）
25
Radio Set
Economy Radio
86.43 MHz
Music Radio
89.53 MHz
Traffic Radio
90,84MHz
Opera Radio
99.53 MHz


File
Catelog▶
Save ▶
Delete ▶
Copy ▶
Clear Write ▶
Select Page
All Select

Section 2 Introduction to Menus

This section simply explains the functions of keys and soft keys on the front panel according to the menu structure and puts them into a table.

Table 4-1 Explanations of Basic Functions

Function Key	Access Key	Explanation
[Freq]	——	Activate the center frequency (or start frequency) to bring out the soft menu for setting the frequency function.
[Center Freq]	[Freq]	Activate the center frequency function to set the spectrum analyzer to the mode of center frequency span.
[Start Freq]	[Freq]	Activate the start frequency to set the analyzer at the start-stop mode.
[Stop Freq]	[Freq]	Activate the stop frequency to set the analyzer at the start-stop mode.
[Freq Step]	[Freq]	Adjust the center frequency step to increase or decrease the center frequency by set step.
[Freq Offset]	[Freq]	Set the output signal frequency of tracking source and the offset value of current sweep frequency of spectrum analyzer.
[Freq Ref] Int Ext	[Freq]	Set the internal reference or external reference, among which the internal reference is default.
[Span]	——	Activate the frequency span to set the spectrum analyzer to the mode of center frequency span, and bring out the soft menu for setting the span.
[Span]	[Span]	Activate the frequency span function to set the spectrum analyzer to the mode of center frequency span.
[Full Span]	[Span]	Set the span of spectrum analyzer to the maximum value.
[Zero Span]	[Span]	Set the span to 0Hz. This function displays the input signal in the amplitude-time mode, so it is particularly useful to observing the modulation signals.
[Last Span]	[Span]	Set the span of spectrum analyzer to the value of previous span.
[AMPT]	——	Activate the reference level function to bring out the soft menu for setting the amplitude.

[Ref Leve]	[AMPT]	Activate the reference level function.
[Attenuation] Auto Man	[AMPT]	Adjust the input attenuator of spectrum analyzer to set it to the auto or manual mode.
[Scale/Div]	[AMPT]	Select the scale of logarithmic amplitude among 1, 2, 5 or 10dB.
[Scale Type] Log Lin	[AMPT]	Select the scale type of vertical axis, linear or logarithmic, among which the logarithmic scale is default.
[Ref Offset]	[AMPT]	Add an offset to all the readings of amplitude, but not change the position of trace on the screen.
[Ref Unit ►]	[AMPT]	Bring out the soft menu for setting the amplitude unit.
dBm	[Ref Unit ►]	Select the dB value against 1mW as the amplitude unit.
dBuV	[Ref Unit ►]	Select the dB value against 1uV as the amplitude unit.
mW	[Ref Unit ►]	Select “Watt” as the unit of displayed amplitude.
mV	[Ref Unit ►]	Select “Volt” as the unit of displayed amplitude.
[Marker]	——	Activate the frequency marker to bring out the soft menu related to frequency marker.
[Marker] 1 2 3	[Marker]	Set the frequency marker to any or several of marker 1, marker 2 and marker 3.
[Marker Trace] 1 2 3 4 5	[Marker]	Select trace 1, 2 or 3 to facilitate the setting of corresponding trace parameters.
[Marker Normal]	[Marker]	Restore the normal marker function.
[Marker Delta]	[Marker]	Set any frequency marker other than marker 1 to the frequency that is the frequency difference marked by △ with the frequency marked by marker 1 as the reference frequency.
[OFF]	[Marker]	Turn off the currently activated frequency marker function menu.
[All Off]	[Marker]	Turn off the all frequency marker functions that are currently activated, and the frequency markers disappear.
[Marker Table] ON OFF	[Marker]	Turn on or off the contents displayed in all the frequency marker tables.
[Marker Fctn]	——	Activate the soft menu related to frequency marker function.
[Function Off]	[Marker Fctn]	Turn off the frequency marker measuring function.
[Freq Count ►]	[Marker Fctn]	Turn on or off frequency counter (activate a frequency marker) to bring out the soft menu related to counter and frequency marker function.

[Freq Count] ON OFF	[Freq Count ►]	Turn on or off frequency counter (activate a frequency marker). When the counter is on, the counting results are displayed.
[Freq BW]	[Freq Count ►]	Set the count resolution.
[Marker Noise]	[Marker Fctn]	Turn on or off frequency marker noise function. When it is on, the average noise level read at the frequency marker is normalized to the noise power of 1Hz bandwidth.
N(3)dB ON OFF	[Marker Fctn]	Turn on and off 3dB measuring function.
[Marker→]	——	Activate the frequency marker to bring out the soft menu related to "Freq Marker→".
[Mkr→CF]	[Marker→]	Set the center frequency equal to the frequency indicated by frequency marker.
[Mkr →CF Step]	[Marker→]	Set the center frequency step equal to the frequency indicated by frequency marker. Change the center frequency with the step key.
[Mkr→Start]	[Marker→]	Set the start frequency equal to the frequency indicated by frequency marker.
[Mkr→Stop]	[Marker→]	Set the stop frequency equal to the frequency indicated by frequency marker.
[Mkr→Ref Lvl]	[Marker→]	Set the reference level equal to the amplitude indicated by frequency marker.
[Mkr△→Span]	[Marker→]	Set the frequency span equal to the frequency marker difference.
[Marker△→CF]	[Marker→]	Set the center frequency equal to the frequency marker difference.
[Peak]	——	Place the frequency marker at the climax of trace to bring out the soft menu related to the frequency marker functions.
[Max Search]	[Peak]	Place the frequency marker at the climax of trace.
[Next Peak]	[Peak]	Move the mobile frequency marker to next peak of trace related to the current frequency marker position.
[Left Peak]	[Peak]	Place the frequency marker at the peak on the left of the current frequency marker.
[Right Peak]	[Peak]	Place the frequency marker at the peak on the right of the current frequency marker.
[Min Search]	[Peak]	Search for the minimum amplitude on the trace, and mark it with a marker.
[Peak→CF]	[Peak]	Move the peak frequency marker to the center frequency.
[Peak Mode]	[Peak]	

Auto Man		
[BW]	——	Bring out the soft menu for setting the bandwidth.
[RBW] Auto Man	[BW]	Adjust the resolution bandwidth of spectrum analyzer, and match the resolution bandwidth with other settings automatically or manually.
[RBW step] Def Cont	[BW]	
[VBW] Auto Man	[BW]	Adjust the video bandwidth of spectrum analyzer, and match the video bandwidth with other settings automatically or manually.
[VBW/RBW] Auto Man	[BW]	Display the ratio of video bandwidth to resolution bandwidth.
[Average] ON OFF	[BW]	Turn on or off the video average function. When it is on, continuously average the smooth trace.
[Sweep Time] Auto Man	[BW]	Adjust the sweep time of spectrum analyzer, and match the sweep time with the resolution bandwidth and span automatically or manually.
Sweep Mode Single Cont	[BW]	Allow to set the mode of continuous sweep or sweep single.
[Trace/Detector]	——	Bring out the soft menu related to trace and detection.
[Trace] 1 2 3 4 5	[Trace/Detector]	Select the currently operable trace register.
[Clear Write]	[Trace/Detector]	Refresh the current curve.
[Max Hold]	[Trace/Detector]	Display and hold the maximum response to input signal in the trace register.
[Min Hold]	[Trace/Detector]	Display and hold the minimum response to input signal in the trace register.
[View]	[Trace/Detector]	Display the content in the current trace register without refreshing.
[Blank]	[Trace/Detector]	Clear the trace register and set it to continuously receive and display new input data.
[Detector ►]	[Trace/Detector]	Bring out the soft menu for setting the detection mode.
[Operations►]	[Trace/Detector]	Bring out the soft menu for mathematic computation related to trace.
[Auto]	[Detector►]	Set the detection mode to auto.
[Normal]	[Detector►]	When detecting the noise, the detection mode displays the positive peak and negative peak alternately. Otherwise, it displays only the positive peak.
[Pos Peak]	[Detector►]	Select the mode of positive peak detection for video

		signal.
[Sample]	[Detector▶]	Sample the video signal in the mode of sampling detection.
[Neg Peak]	[Detector▶]	Select the mode of negative peak detection for video signal.
[1 ↔ 2]	[Operations▶]	Exchange the contents in trace register 1 and trace register 2, and then place trace 1 and trace 2 in the display mode at the same time.
[2 - DL → 2]	[Operations▶]	Take off the value of display line from trace register 2, and then place the result back into trace register 2.
[2 ↔ 3]	[Operations▶]	Exchange the contents in trace register 12 and trace register 3, and then place trace 2 and trace 3 in the display mode at the same time.
[1 → 3]	[Operations▶]	Exchange the contents in trace register 1 and trace register 3, and then place trace 1 and trace 2 in the display mode at the same time.
[2 → 3]	[Operations▶]	Exchange the contents in trace register 2 and trace register 3, and then place trace 2 and trace 3 in the display mode at the same time.
[Display]	——	Bring out the soft menu related to the display function.
[Ref Scale] ON OFF	[Display]	Set to the full screen display.
[Zoom] ON OFF	[Display]	Select the display line to change its display position.
[Display Line] ON OFF		When the menu is on, activate an adjustable horizontal reference line on the screen.
[Graticule] ON OFF	[Display]	Display or conceal the lattice.
[Annotation] ON OFF	[Display]	Display or conceal the marked information on the screen.
[Trace Color▶]	[Display]	Bring out the color editing menu of trace.
[Graticule Color] Red Green Blue	[Display]	Bring out the color editing menu of lattice.
[Trig]	——	Bring out the soft menu for setting the trigger mode.
[Free Running]	[Trig]	Set the trigger mode to the free trigger, so as to make the sweep trigger as quickly as allowed by spectrum analyzer.
[Video]	[Trig]	Set the trigger mode to video trigger. When the input signal triggers the level through video at any time, it can generate the sweep signal with slope.

[Line]	[Trig]	Set the trigger mode to linear.
[Measure]	——	Bring out the soft menu containing power measure, adjacent-channel power (ACP) measure, bandwidth measure and FFT measure.
[Measure Off]	[Measure]	Turn off all the measuring functions.
[ACPR] ON OFF	[Measure]	Bring out the soft menu to measure the adjacent-channel power of transmitter.
[Channel Power] ON OFF	[Measure]	Enter the soft menu for measuring the channel power.
[OBW] ON OFF	[Measure]	Enter the soft menu for measuring the occupied bandwidth.
[Time Spec] ON OFF	[Measure]	Turn on the time spectrum measuring mode.
[Channel Select] Cal Int RF in	[Measure]	Switch the internal calibration signal and video input signal.
[Meas Setup]	——	Measure setup menu, which is used to measure adjacent-channel power, channel power and occupied bandwidth.
[Channel Width]	[Meas Setup]	Display the power in integral, and back to set the bandwidth at the percentage of total display power.
[Channel Interval]	[Meas Setup]	The space between the center frequencies of main channel and adjacent channel.
[Channel Nums]	[Meas Setup]	Set the numbers of upper and lower adjacent channels in the adjacent-channel power measurement.
[Power BW]	[Meas Setup]	Calculate the occupied power bandwidth corresponding to the power between two frequency markers.
[System]	——	Bring out the soft menu for system menu setting.
[System Log►]	[System]	Check the inner errors of instrument.
[Date /Time►]	[System]	Set the date and time displayed on the system menu.
[Date /Time] ON OFF	[Date /Time►]	Display and conceal the date and time.
[Set Date]	[Date /Time►]	Set the date menu.
[Set Time]	[Date /Time►]	Set the time menu.
[Calibrate►]	[System]	Enter the user calibration interface.
[Config I/O►]	[System]	Bring out the soft menu of system interface address of instrument.
[IP Addr]	[Config I/O►]	Set the IP address of spectrum analyzer.

[Mask]	[Config I/O▶]	Set the value of subnet mask.
[Gate Way]	[Config I/O▶]	Set the gateway address.
[GPIB Addr]	[Config I/O▶]	Set the GPIB address of spectrum analyzer.
[Host IP]	[Config I/O▶]	Set the host IP address.
[Host Port]	[Config I/O▶]	Set the host port address.
[Language] Chinese English	[System]	Set the interface language, with Chinese as default.
[Service▶]	[System]	Bring out the soft menu of system service.
[Back light]	[System]	Set the backlight brightness of LCD.
[Print Setting]	——	Bring out the soft menu related to print.
[File]	——	Bring out the soft menu for file management.
[Catalog▶]	[File]	Used to check the stored files.
[Save▶]	[File]	Used to save files in the instrument or flash memory.
[Delete▶]	[File]	Used to delete the selected file or all files.
[Copy▶]	[File]	Copy the selected file to flash memory, or all files.
[Refresh▶]	[File]	Check the latest stored files at the catalog mode.
[Select Page]	[File]	Default is to select all in current page.
[Select All]	[File]	Default is to select all the files in the catalog.
[Save]	——	Used to store the data of current instrument into the system memory.
[Preset]	——	Set the spectrum analyzer to the reset mode.

Section 3 Menu Explanations

[FREQ]

[Center Freq]

Activate the center frequency and set the spectrum analyzer to center frequency/span mode. Adjust the center frequency with numeric keys, step keys or knob. If the set center frequency does not match with the current span, the span will be automatically adjusted to the best value in correspondence with the expected frequency.

[Start Freq]

Activate the start frequency and set the spectrum analyzer to start frequency/stop frequency mode. Adjust the start frequency with numeric keys, step keys or knob. When adjusting the start frequency, if the selected start frequency exceeds the stop frequency, the stop frequency will increase automatically until it is equal to the start frequency.

[Stop Freq]

Activate the stop frequency and set the spectrum analyzer to start frequency/stop frequency mode. Adjust the stop frequency with numeric keys, step keys or knob. When adjusting the stop frequency, if the selected stop frequency is lower than the start frequency, the start frequency will decrease automatically until it is equal to the stop frequency.

[Freq Step Auto Man]

Adjust the step of center frequency. When this function is at the auto mode and the center frequency is activated, press the step key once, if its span is higher than 0Hz, the center frequency changes by a step (equal to 10% of the span); if the span is 0Hz, the center frequency changes by a step, equal to 25% of the resolution bandwidth. In the manual mode, adjust the step of the center frequency with numeric keys, step keys or knob. At that time, reactivate [Center Freq] and press the step key to change the center frequency by the set step. This function is very useful to rapidly adjust the center frequency to the harmonic of input signal. For instance, observe the harmonic of 300MHz input signal, set [Freq Step Auto Man] to manual, and input 300MHz. If the center frequency is 300MHz at this time, press the step key to change the center frequency to 600MHz, equal to second harmonic. Press the step key to increase the center frequency by 300MHz to 900MHz. In the menu [Freq Step Auto Man], the underline indicates that the setting of step is in the auto mode or manual mode. When the step is in the manual mode, press [Freq Step Auto Man] and then switch to the auto mode.

[Freq Offset]

Add the set offset to the displayed frequency, including the frequency indicated by frequency marker. This does not affect the scope of swept frequency. Input the offset with numeric keys, step keys or knob. When this function is activated (in other words, the frequency

offset is not 0Hz).

[Freq Ref Int Ext]

Set the frequency reference from internal or external timing input, and as the overall reference.

[Span]

Activate the span function and set the spectrum analyzer to the center frequency/span mode. The [Span] key can bring out [Span], [Full Span], [Zero Span] and [Last Span] at the same time. The setting of span can be changed with numeric keys, step keys or knob. Numeric key or [Zero Span] can be used to set the span to zero.

[Full Span]

Set the spectrum analyzer to the center frequency/span mode, and increase the span to the maximum.

[Zero Span]

Set the span to 0. This is helpful to observing the signals in the time domain, especially observing the modulation signals.

[Last Span]

Return the spectrum analyzer to the previously selected span.

[AMPT]

Bring out the menu of amplitude function, including: [Ref Level], [Attenuator Auto Man], [Scale/Div], [Scale Type Log Lin], [Ref Offset], and [Ref Unit].

[Ref Level]

Activate the reference level function. Adjust the reference level with numeric keys, step keys or knob. The reference level appears at the top of the corresponding coordinate lattice. It is relatively more accurate to measure the signal at the position near the reference level, but the amplitude of input signal should not be higher than the reference level during measurement. If the level of measured signal is higher than the reference level, there may be signal compression and distortion during measurement, so the measuring results will be untrue. The input attenuator of spectrum analyzer is related to the reference level, and it can automatically adjust to avoid the compression of input signal. When the attenuation is 0dB, the minimum reference level at the logarithmic scale is -80dBm.

[Attenuator Auto Man]

It is only valid in the internal mixing mode, and used to adjust the input attenuator of spectrum analyzer. In the auto mode, the input attenuator is correlated to the reference level. In the manual mode, the attenuation of attenuator can be adjusted with numeric keys, step keys or knob. The scope of attenuation is 0dB~50dB, at the step of 2B, while the attenuation of 0dB can be set only with the numeric key. The attenuator is normally set to the auto mode. If the reference level changes, the attenuation can be adjusted automatically. However, the change of attenuation does not affect the reference level. The adjustment of attenuator intends to realize that the maximum signal amplitude of input mixer is lower than or equal to -10dBm. For instance, if the reference level is +22dBm, the attenuation is 32dB and the input level of mixer is -18dBm (22-32-8=-18). Its ultimate goal is to prevent signal compression. The attenuator can be set to the manual mode through [Attenuator Auto Man], in order to adjust the attenuator

manually. The underline under the word "Auto" or "Man" indicates that the attenuator is in the automatic coupling mode or the manual setting mode. When the attenuator is in the manual setting mode, press [Attenuator Auto Man] to reconnect the attenuator with the reference level.

Attention: The maximum input signal amplitude is +30dBm for the input attenuator (with the input attenuation of at least 10dB). Any signal with higher power may damage the input attenuator or input mixer.

[Scale/Div]

Select the logarithmic amplitude scale of 1, 2, 5 or 10dB. The default value is 10dB/lattice. Any activated frequency marker employs dB as the unit of reading. The frequency marker difference employs dB as the unit to read the difference between two frequency markers. If necessary, it is allowed to select any other unit in the logarithmic/linear scale mode. Refer to the description of [Ref Unit] softkey function.

[Scale Type Log Lin]

It is valid only in the internal mixing mode, and used to select the linear amplitude scale. It is normally in mV. There are also other units available.

[Ref Offset]

It introduces the offset to all the amplitude readings (e.g. reference level and frequency marker amplitude), but it does not change the position of trace on the screen. The offset is in dB, and does not change with the selected scale and unit. The offset can be input with numeric keys, step keys or knob.

[Ref Unit]

It brings out the soft menu for setting the amplitude unit of spectrum analyzer, including [dBm], [dBμV], [dBmV], [V] and [W].

[dBm]

Select the decibel by 1mW as the amplitude unit.

[dBμV]

Select the decibel by 1μV as the amplitude unit.

[dBmV]

Select the decibel by 1mV as the amplitude unit.

[V]

Select the Volt as the unit of displayed amplitude.

[W]

Select the Watt as the unit of displayed amplitude.

[Marker]

[Marker 1 2 3]

Activate a single frequency marker and place the frequency marker in the middle of trace. If the frequency marker difference has been activated, this softkey will lead to the menu under the [Difference] function.

If there is already a frequency marker, this order will not cause any operation. If there are already two frequency markers (e.g. in the [Difference] mode), [Freq Marker] changes the

mobile frequency marker into a new single frequency marker. From the frequency marker, the amplitude and frequency information (the time information when the span is 0Hz) can be obtained. Moreover, their values are displayed in the active function area and at the right upper corner on the screen. The mobile frequency marker can be moved with numeric keys, step keys or knob.

The frequency marker can read the data on the current mobile trace (which may be trace A or trace B). If two traces are activated, or both of them are in the static display mode, the frequency marker will read the data on trace A.

[Marker Trace 1 2 3 4 5]

It is used to activate the frequency marker of each trace during the trace measurement.

[Normal Marker]

It is used to activate the marker for measurement during the common measuring mode.

[Marker Delta]

In the active area and at the right upper corner of the display area, the amplitude difference and frequency difference between two frequency markers are displayed. If a single frequency marker exists, [Difference] will place a static frequency marker and an active frequency marker at the original position and a single frequency marker position. The mobile frequency marker can be moved with knob, step keys or numeric keys. If there are two frequency markers, directly press [Difference]. If [Freq Marker Difference] has been activated, press [Difference] to place the static frequency marker at the position of mobile frequency marker. The displayed amplitude frequency is in dB, or in the linear unit converted at the corresponding proportion.

[OFF]

Turn off the currently opened frequency marker function menu.

[All Off]

Turn off and conceal all the frequency markers. This softkey can turn off all the activated function softkeys related to frequency marker.

[Marker→]

It brings out the soft menus related to the frequency marker function. These menus are related to whether the frequency, span and frequency marker of spectrum analyzer are normal or in the difference frequency marker mode:

[Mkr→CF]

Set the center frequency equal to the frequency indicated by frequency marker. This function can rapidly move the signal to the center of the screen.

[Mkr→Ref Lvl]

Set the reference level equal to the amplitude indicated by frequency marker.

[Mkr→CF Step]

Set the step of center frequency equal to the frequency indicated by frequency marker.

[Mkr△→CF]

Set the center frequency of spectrum analyzer equal to the frequency marker difference.

When this function is activated, static frequency marker and mobile frequency marker will be placed near the new center frequency. This function is useful to the measurement of harmonic distortion, and the frequency marker difference can be used to mark the difference between two harmonics. Moreover, [Freq Difference→Center Freq] can be also used to fine tune the frequency of fundamental wave.

[Mkr△→Span]

Set the frequency span equal to the frequency of frequency marker difference, so as to rapidly reduce the span as required.

[Freq Count]

Activate the function of frequency counter and display the counting results at the right upper corner of the screen. The counter only counts the signal displayed on the screen. The frequency count can also bring out a soft menu for additional counter functions, including [Freq Marker Count ON OFF] and [Res].

[Freq Marker Counter ON OFF]

Turn on or off the frequency counter mode. When the tracking signal generator is activated, this function is invalid. The counting result is displayed at the right upper corner of the screen.

[Counter Res]

The counter resolution includes 1kHz, 100Hz, 10Hz and 1Hz. By changing the counter resolution, it can change the accuracy of counter. The larger resolution, the higher accuracy of counting.

[Peak]

[Max Search]

Place a frequency marker at the climax of trace, and display its frequency and amplitude at the right upper corner of the screen. [Max Search] does not change the activated functions.

[Next Peak]

Move the mobile frequency marker to next climax on the trace, which is related to the position of the current frequency marker. When this key is pressed down repetitively, it can quickly find a lower peak.

[Left Peak]

Search for a peak on the left of the current frequency marker. Next peak must meet the standard of current peak and peak threshold.

[Right Peak]

Search for next peak on the right of the current frequency marker. Next peeak must meet the standard of current peak and peak threshold.

[Min Search]

Place a frequency marker at the climax of trace, and display its frequency and amplitude at the right upper corner of the screen.

[Peak→CF]

It is used to move the peak to the center frequency.

[Peak Mode Auto Man]

Set the peak search to the auto or manual mode.

[BW]

It brings out the soft menu for setting the bandwidth, including [RBW Auto Man], [VBW Auto Man], [VBW/RBW Ratio Auto Man], [Average ON OFF], [Sweep Time Auto Man], [Sweep Mode Single Cont]. Meanwhile, [BW] can also activate the resolution bandwidth function.

[RBW Auto Man]

Adjust the resolution bandwidth within the scope of 5Hz~3MHz. The resolution bandwidth can be changed with numeric keys, step keys and knob. The underline at the word “Auto” or “Man” indicates that the resolution bandwidth is in the automatic mode or manual mode. Press [RBW Auto Man] till the underline at the word “Auto” is highlighted, so the resolution bandwidth is in the automatic coupling mode.

[Res Step Def Cont]

Adjust the resolution bandwidth and change the resolution step in the mode of 1-3-5-10 default step or “continuous” step.

[VBW Auto Man]

Adjust the video bandwidth displayed in the active function area within the scope of 5Hz~3MHz, and by continuous and sequential step. The value can be adjusted with numeric keys, step keys or knob. The highlighted underline at the word “Auto” or “Man” indicates that the bandwidth is in the automatic or manual mode. When the video bandwidth is in the manual mode, press [Video BW Auto Man] to highlight the underline at the word “Auto” and switch to the automatic mode. When the video bandwidth is lower than or equal to 100Hz and the resolution bandwidth is higher than or equal to 300Hz, the detector will automatically switch to the sampling mode.

[VBW/RBW Auto Man]

Set the ratio of current video bandwidth to resolution bandwidth. If the resolution bandwidth changes, the video bandwidth should also change to guarantee the ratio. The ratio is displayed in the active function area for the connection mode between two bandwidths. The ratio is changed sequentially by the step of 1, 3, 10 within the scope of 0.003~3, and its default value is 1. When selecting a new ratio, the video bandwidth will be changed to satisfy the new ratio, while the resolution bandwidth does not change.

[Average ON OFF]

Turn on or off the video average function. Without employing the narrow video bandwidth, video average can display the trace smoothly. This function sets the detector to the sampling mode, while continuously averaging the trace to obtain the smooth trace.

[Sweep Time Auto Man]

Adjust the sweep time of spectrum analyzer. Adjust the sweep time with numeric keys, step keys or knob. The highlighted underline at the word “Man” means that the sweep time can be set manually. When highlighting the underline at the word “Auto”, the sweep time will be automatically related to the setting of resolution bandwidth, span and video span.

[Sweep Mode Single Cont]

It allows setting the mode of sweep single. Press [Single] to activate the mode of sweep single. Press [Single] to restart the sweep when next trigger signal arrives. It allows setting the mode of continuous sweep. Press [Cont Sweep] to activate the mode of continuous sweep.

[Trace/Detector]

It brings out the soft menu related to trace and detection, including [Trace 1 2 3 4 5], [Clear Write], [Max Hold], [Min Hold], [View], [Blank], [Detectior ►], [Operations►], [Normal], [Pos Peak], [Sample], [Neg Peak], [1 ↔ 2], [2 - DL → 2], [2 ↔ 3], [1 → 3] and [2 → 3].

[Trace 1 2 3 4 5]

Select the trace. Spectrum analyzer provides the traces 1, 2, 3, 4 and 5. The selected trace No. and its trace in the status menu are marked with underline.

[Clear Write]

Refresh the current spectrum curve and display the latest spectrum trace.

[Max Hold]

Display the maximum response to the input signal held in the trace. In this mode, the trace can continuously receive the sweep data and select the positive peak detection mode.

[Min Hold]

Display the minimum response to the input signal held in the trace. In this mode, the trace can continuously receive the sweep data and select the negative peak detection mode.

[View]

Display the contents in the current trace, but not refresh.

[Blank]

Clear the trace on the screen. However, the contents in the trace register remain unchanged and are not refreshed.

[Detector ►]

Bring out the soft menu for setting the detection mode, including [Auto], [Normal], [Pos Peak], [Sample], [Neg Peak].

Table 4-2 Comparison of Detection Modes

Detection Mode	Measurement
Auto	The standard detection is the commonest detection mode. It can see the signal and background noise at the same time, without losing any signal.
Pos Peak	The positive peak detection ensures that no peak signal is missing, so it is helpful to measuring the signals that are very close to background noise.
Sample	Sampling detection is helpful to measuring the noise signal. Compared with the standard detection mode, it can better measure the noise.
Neg Peak	In most cases, negative peak detection is used in the self-test of spectrum analyzer, and rarely used in the measurement. It can greatly realize the reappearance of AM signal modulation envelope.

[Auto]

Set the detector to the standard detection mode (default mode). In this mode, when detecting the noise, the measuring results of positive peak and negative peak appear alternately, in order to realize the display effect similar to analog instrument. Otherwise, only the positive peak appears.

[Pos Peak]

Select the positive peak detection mode. This mode is used to detect the positive peak noise level in the trace. When it is [Max Hold], the positive peak detector is selected.

[Sample]

Set the detector to the sampling detection mode. This mode is normally used for the video average and noise frequency marker function.

[Neg Peak]

Select the negative peak detection mode. This mode is used to display the negative peak noise level in the trace.

[1 ↔ 2]

Exchange the contents of trace register 1 with the contents of trace register 2, and place the contents of both trace registers in the display mode at the same time.

[2 - DL → 2]

Deduct the value of display line from trace register 2. This function is executed once after activating once. If it is needed to be executed again, it is necessary to press [2 - DL → 2] again. When this function is activated, the display line is also activated.

[2 ↔ 3]

Exchange the contents of trace register 2 with the contents of trace register 3, and place the contents of both trace registers in the display mode at the same time.

[1 ↔ 3]

Exchange the contents of trace register 1 with the contents of trace register 23, and place the contents of both trace registers in the display mode at the same time.

[Display]

Bring out the soft menu related to display, including the function of turning on or off reference scale, zoom, display line, lattice, note, trace color and lattice color, etc.

[Ref Scale ON OFF]

Turn on or off the reference scale function menu.

[Zoom]

Turn on the zoom to measure the signal. The measured signals are displayed at the small sweep on the lower half of the screen.

[Display Line]

Activate the display line controlled through numeric keys, step keys or adjusting knob.

[Graticule ON OFF]

The menu for displaying and concealing the lattice. When the lattice display line is on, press [Graticule ON OFF] again to turn it off.

[Annotation ON OFF]

Define whether to display or conceal the notes appearing in the designated area of display lattice.

[Trace Color]

Set the trace color to identify several traces.

[Graticule Color]

Set the menu of lattice color.

[Measure]

Bring out the inbuilt and customized measurement function soft menus of spectrum analyzer, and turn on or off the menus of adjacent-channel power measurement, channel power

measurement, occupied bandwidth, time spectrum measurement as well as the switch of internal calibration signal and external input signal.

[ACPR ON OFF]

Turn on or off the adjacent-channel power measurement. Press [Meas Setup] to bring out the parameter setting soft menu of adjacent-channel power measurement. The adjacent-channel power is used to measure the ratio of adjacent-channel powers in the transmitter, and employ the linear power integral mode to obtain the absolute value of main channel power and the absolute value of adjacent-channel power, so as to obtain the adjacent-channel power ratio.

[Channel Power ON OFF]

Turn on or off the channel power measurement. Press [Meas Setup] to bring out the parameter setting soft menu of channel power measurement. The channel power is used to measure the ratio of channel powers in the transmitter. According to the channel bandwidth set by user, the linear power integral mode is employed to obtain the absolute value of main channel power.

[OBW ON OFF]

Turn on or off the occupied bandwidth measurement. Press [Meas Setup] to bring out the parameter setting soft menu of occupied bandwidth measurement. Occupied bandwidth is used as a measurement for measuring the occupied bandwidth of transmitter signal. It can be measured according to the proportion of in-band power in the total power within the scope of frequency. Its default value is 99% (which can be set by user).

[System]

Bring out the soft menu related to the system parameter setting, including [System Log▶], [Date/Time▶], [Calibrate▶], [Language Chinese English], [Config I/O ▶], [Service ▶] and [Back Light]. When spectrum analyzer is used for the first time, after setting the date and time, the system will store the settings. It will not be reset after powering off and then powering on.

[System Log]

System self-test menu.

[Date/Time]

It is used to set the date and time of instrument and the formats of date and time.

[Config I/O ▶]

Bring out the soft menu for setting the interface address of spectrum analyzer. The spectrum analyzer supports the communications of GPIB, RS232, LAN and USB ports.

[GPIB Addr]

Display the current GP-IB address of spectrum analyzer. The system default value is 18. New address can be input with numeric keys, step keys or knob. Once a new GP-IP address is input, it is necessary to continue the execution of [Store GPIB Address]. If the order [Store GPIB Address] is not executed, if it is reset, the redefined GP-IB address is still valid. However, the new address

will be lost after powering off.

[IP Addr]

Used to set the gateway IP address.

[Host Port]

Set the host port address.

[Mask]

Used for the parameter of subnet mask.

[Gateway]

Used for the parameter of default gateway address.

[Language Chinese English]

Used to set the language of system interface, with Chinese as default.

[Service▶]

Bring out the soft menu related to system service to adjust the parameters before delivery.

[File]

Bring out the soft menu of file management.

[Catalog▶]

Used to unfold the catalog of file management.

[Save▶]

Used to save the selected file to flash memory or all files.

[Delete▶]

Delete the selected file or all

[Copy▶]

Copy the selected file or all files into flash memory.

[Refresh]

Refresh the current catalog.

[Select Page]

Default is to select all files in current page.

[Select All]

Default is to select all files.

[Save]

Save the files or pictures into the memory of the instrument.

[Print Setup]

Bring out the soft menu related to the print of spectrum analyzer.

[Preset]

Set the spectrum analyzer to a preset status. [Preset] does not affect the GP-IP address of spectrum analyzer, the content of trace register, the stored preselector data or any locked status.

Part Two Technical Specifications

Chapter V Working Principles and Critical Technologies

Section 1 Overall Working Principles and Hardware Functional Block Diagram

SSA3030 radio frequency spectrum analyzer is a superheterodyne sweep spectrum analyzer. It mainly consists of radio frequency part, intermediate frequency (IF) part, data acquisition and DSP processing part, embedded control, display part and power supply, etc. Its overall hardware functional block diagram is shown in Fig. 5-1.

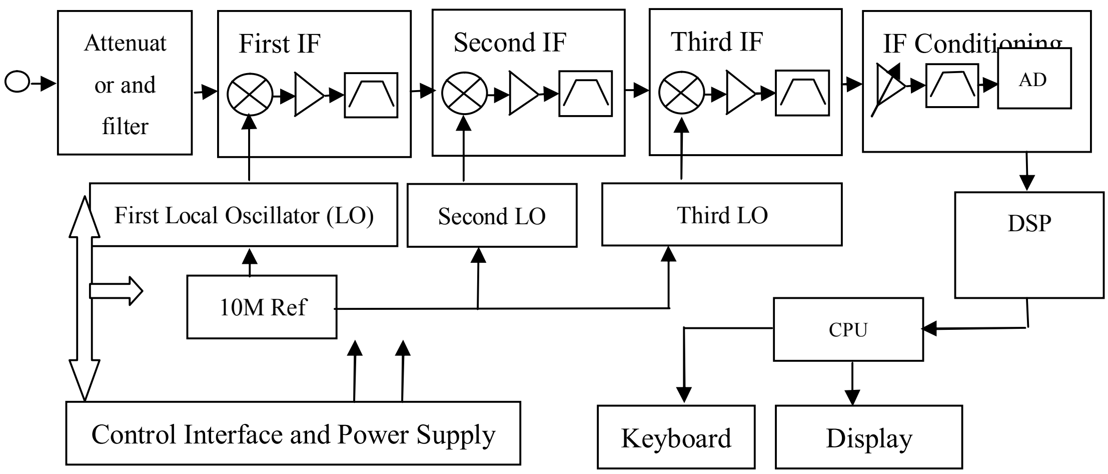


Fig. 5-1 Functional Block Diagram of SSA3030 Spectrum Analyzer

As shown in Fig. 5-1, a RF input signal within 9kHz～3GHz is, after passing the attenuator and low pass filter (or band-pass filter), sent to the first mixer. In the first mixer, the input signal is mixed with the first LO signal to generate the first IF signal of 1221.4MHz. After passing the mixer, there is a low-noise amplifier used to compensate the conversion loss in the first mixer. Subsequently, the signal passes the 3dB first IF filter with the bandwidth of 50MHz, in which the needed first LO signal is supplied by the bandwidth voltage controlled oscillator. The first IF signal is mixed with the second LO signal in the second mixer to generate the second IF signal of 465.4MHz. After the mixer, there is still low-noise amplifier. Subsequently, the second IF signal passes the 3dB IF filter with the bandwidth of 20MHz. Then, the second IF signal enters the third mixer, and mixes with the third LO signal to generate the third IF signal of 21.4MHz. After

passing the amplifier with controllable gain and the 3dB anti-alias filter with the bandwidth of 3MHz, the 21.4MHz signal is sent to AD converter and converted to digital signal. After the digital IF signal is sent to digiboard, it is down converted in FPGA to the baseband signal and then put into filter shaping in the digital RBW filter. After that, the signal is sent to digital detection, video detection and video detection, and then converted into the logarithmic format and sent to main control CPU. The CPU rectifies the errors in the IF processed data and compensates them, and then displays them on the screen.

In the SSA3030 spectrum analyzer, the full digital IF processing technology is employed. All of its IF bandwidth filters, video bandwidth filters and video detectors adopt the digital signal processing mode. A part of radio frequency is down converted to the third IF of 21.4MHz, and then sent to AD through anti-alias filter. Subsequently, it is put into digital IF processing. The hardware structure block diagram of the whole digital IF receiver is shown in Fig. 5-2.

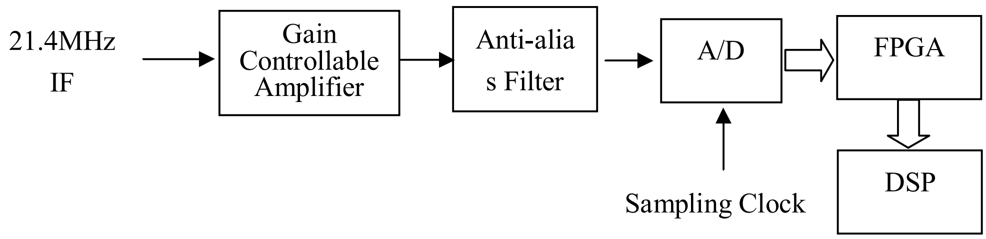


Fig. 5-2 Hardware Structure Diagram of Digital IF Receiver

Large-capacity high-speed FPGA chip is mainly used to realize the high-speed signal processing, including digital signal acquisition, digital down conversion, decimation filter, resolution bandwidth shaping filter, etc., while DSP completes the low-speed IF signal processing related to completed computations, including digital detection, digital video filter, video detection and signal demodulation, etc. The realized resolution bandwidth ranges from 3MHz to 5Hz.

Section 2 Overall Features, Functions and Critical Technologies

SSA3030 is a high-performance and portable radio frequency spectrum analyzer. It is used to measure various parameters including spectrum purity, signal distortion, shading and intermodulation, etc. and analyze the modulation signals, e.g. the transmitter's transmitting power, bandwidth, harmonic/anharmonic wave, and uplink/downlink frequency of satellite communications equipment, the tactical radio's adjacent-channel power, and other indicators, It can be used in the fields of communications, radar, navigation, electronic countermeasure, spectrum management and signal detection, etc.

Features:

- The frequency range of 9kHz~3GHz;
- The resolution bandwidth of 5Hz~3MHz, continuously changed by the step of 1 to 10 when

it is below 500kHz;

- An ultra large display with 8.4-inch LED backlight and operating menus in Chinese and English;
- The capability to store 100 spectrum display traces;
- Display the measurement of up to 5 traces simultaneously;
- A large variety of communications interfaces including USB, LAN, VGA, GPIB and RS232;
- Small size, light weight, compact design and high flexibility.

Functions:

Signal identification function	Modulation signal measurement	Harmonic distortion measurement	Noise frequency marker test
Adjacent-channel power measurement	Occupied bandwidth measurement	Channel power measurement	3dB bandwidth measure
Chromatogram	Frequency measurement	Broadcast signal monitoring	

Critical Technologies:

SSA3030 radio frequency spectrum analyzer employs digital IF technology, RF microwave integration technology, intelligent control power supply technology, embedded control technology, high-speed data acquisition technology, electromagnetic compatibility technology, graphics processing, system software design technology, etc., so as to considerably improve the overall performance and extensibility.

Chapter VI Main Technical Indicators and Testing Methods

Section 1 Main Technical Indicators

Frequency

Frequency Range: 9kHz ～ 3.0GHz

Sweep Width: 100Hz ～ 3.0GHz, 0Hz (manually selected or press the automatic step of 1, 2, 5)

Sweep Accuracy: ±0.5% span

Reading Accuracy: ±(reference accuracy+sweep accuracy+50%RBW)

Noise Sideband: -80dBc/Hz @10kHz frequency offset

Amplitude

Meausrement Range: +30dBm ～ -120dBm

Display average noise level:

Center Freq	RBW	Max
100 MHz	10Hz	-124 dBm
500 MHz	10Hz	-122 dBm
900 MHz	10Hz	-120 dBm
1200MHz	10Hz	-126 dBm
1800MHz	10Hz	-123 dBm
2200MHz	10Hz	-121 dBm
2600MHz	10Hz	-120 dBm
3000MHz	10Hz	-118 dBm

Mixer Frequency Conversion Compression: ＜1dB (total power of mixer -15dBm)

Display Range:
100dB (logarithmic scale 10dB/div)
50 dB (logarithmic scale 5dB/div)
20 dB (logarithmic scale 2dB/div)

10 dB (logarithmic scale 1dB/div)
10-lattice (Linear scale)

Amplitude Scale: dBm, dBmV, dBμV, V, W

Logarithmic Scale Accuracy: ±1dB (offset reference level 0dBm ～ -50dBm)

Frequency Response: ±1.5dB （1MHz ～3.0GHz）

Input Attenuator: 0dB ～ 50dB, by step of 10dB

Reference Level Accuracy: ±1.5dB （1 MHz ～ 3.0GHz）

Residual Response: ≤-80dBm (typical value -86dBm) (1MHz ～ 3.0GHz, input attenuator 0dB, no input signal)

Second Harmonic Distortion: ≤-60dBc （10MHz ～ 3.0GHz, -40dBm input, input attenuator 0dB）

Three-order IMD ≤-60dBc （10MHz ～ 3.0GHz, -30dBm input, input attenuator 10dB）

Resolution Bandwidth: range of 10Hz～3MHz (continuous step of 1 to 10 below 500kHz, 1MHz, 3MHz)

Conversion Error: ±0.5dB

Video Bandwidth: 10Hz～1MHz(by step of 1, 3, 5, 10)

Sweep

Sweep Time Range:10ms ～ 3000s (span ≥100Hz)
1ms ～ 3000s (zero span)

Sweep Time Accuracy: time base error ±0.5% sweep time

Section 2 Recommended Testing Methods

This section introduces the recommended testing methods for the main technical indicators of SSA3030 radio frequency spectrum analyzer. These indicators can fully reflect the performance and status of spectrum analyzer. The spectrum analyzer to be tested needs to start up and display normally, and passes all the self-test without any failure. Its keys should function normally before testing the indicators. The devices used in the recommended testing methods include combined sweep signal source E4421B, combined signal generator E4422B and power meter. Other testing equipments suitable for indicators can be also used, but they must be measured as qualified, and guaranteed to be accurate and reliable.

1 Test of frequency reading accuracy

a) Explanation of test item

Frequency reading accuracy refers to the degree of difference between the frequency of signal read through the marker of spectrum analyzer and the actual frequency of signal. In SSA3030 spectrum analyzer, the expression of frequency reading accuracy is

Frequency reading accuracy: ±(measured frequency×time base reference accuracy+span accuracy+0.5×RBW)

b) Testing block diagram and testing device and equipment

Table 6-1: Required Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range:250kHz～3GHz Power output:-120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B

The testing block diagram is shown in Fig. 6-1:

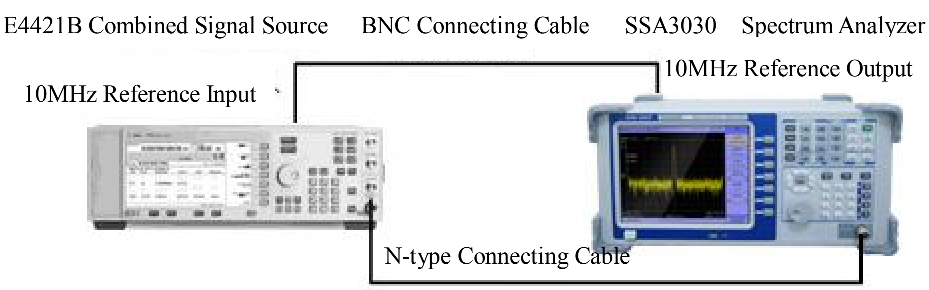


Fig. 6-1 Test Connection Diagram of Frequency Reading Accuracy

c) Test procedure

1) Connect the equipment as shown in Fig. 6-1 and preheat for 30min. Be aware that SSA3030 and combined signal generator share the time base.

2) Reset the combined signal generator and set the frequency of 1200MHz and the power of -10 dBm.

3) Reset and calibrate SSA3030, and then set the center frequency of 1200MHz and the sweep width of 100kHz.

4) Execute the SSA3030 peak search and record the frequency reading of frequency marker in Table A.1.

5) Refer to Table 6-1, change the span of analyzer to 1MHz, 10MHz and 100MHz, and repeat step (4).

6) Calculate the frequency reading accuracy: ±(measured frequency×time base reference accuracy+span accuracy+0.5×RBW)

d) Test records and data processing

Record the test results in the performance indicator test record table.

2 Test of span accuracy

a) Explanation of test item

Span accuracy refers to the degree of difference between the set span of spectrum analyzer and the actual LO sweep width. In SSA3030 spectrum analyzer, the indicator requirement for span accuracy is

Span accuracy $\delta \leq \pm 0.5\%$

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-2

Table 6-2 Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B

The testing block diagram is shown in Fig. 6-2:

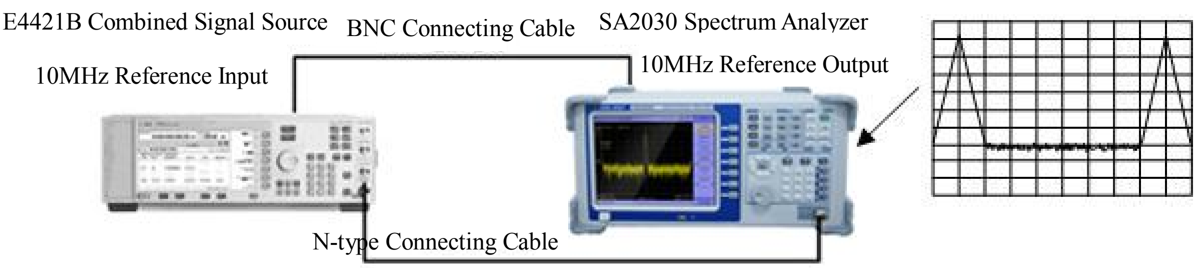


Fig. 6-2 Test Connection Diagram of Span Accuracy

c) Test procedure

(1) Connect the equipment as shown in Fig. 2. Be aware that SSA3030 and combined signal generator share the time base.

(2) Reset the combined signal generator and set the frequency of 1.2 GHz and the power of -10 dBm.

(3) Reset and calibrate SSA3030, and then set the center frequency of 1.2GHz and the sweep width of 100kHz.

(4) Adjust the output frequency f1 of combined signal generator to place its peak at the first gridline from the left on the screen.

(5) Adjust the output frequency f2 of combined signal generator to place its peak at the ninth gridline from the left on the screen.

(6) Calculate the measured span by 10*（f2-f1）/8, and record it in Table A.1.

(7) Refer to Table A.1 and change the span of analyzer to 1MHz, 10MHz and 100MHz respectively. Repeat step (4) and step (6).

d) Test records and data processing

Record the test results of spans in the performance indicator test record.

3 Test of resolution bandwidth switch uncertainness

a) Explanation of test item

The resolution bandwidth switch uncertainness refers to the degree of difference between the amplitudes read when the signals with the same amplitude are input and spectrum analyzer sets different resolution bandwidths. In the SSA3030 spectrum analyzer, the indicator requirement for resolution bandwidth switch uncertainness is:

<±0.5dB

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-3.

Table 6-3: Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B

Testing block diagram is shown in Fig. 6-3.

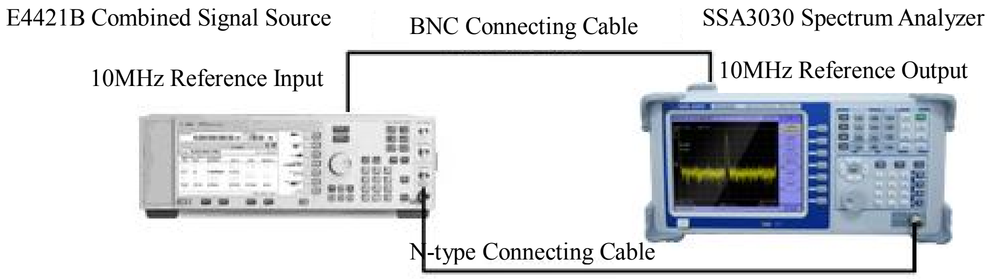


Fig. 6-3 Test Connection Diagram of Resolution Bandwidth Switch Uncertainness

c) Test procedure

(1) Connect E4421B combined signal source and SSA3030 spectrum analyzer as shown in Fig. 3.

(2) Reset and calibrate SSA3030, and then set the following parameters:

Center Frequency: 500MHz
Sweep Width: 50kHz
Resolution Bandwidth: 3kHz
Reference Level: -10dBm
Logarithmic Scale: 5dB/DIV

(3) Set E4421B combined signal source as follows:

Frequency: 500MHz
Amplitude: -15dBm
RF On/Off: ON

(4) Press [PEAK] and select “MARKERΔ”.

(5) Set SSA3030 resolution bandwidth and span according to Table A.1.

(6) Press the [PEAK] key, record the “MARKERΔ” amplitude reading in the performance test record, and fill its value in the scope as specified in the table.

(7) Repeat steps (5)~(6) according to Table A.1.

d) Test records and data processing

Record the test results in the performance indicator test record table.

4 Test of noise sideband

a) Explanation of test item

The test of noise sideband is about the short-term stability of LOs (mainly the first LO) of spectrum analyzer at the designated frequency and frequency offset. In SSA3030 spectrum analyzer, the indicator requirement for noise sideband is ≤-81dBc/Hz @10kHz frequency offset.

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-4.

Table 6-4: Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm	E4421B

		Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	

The testing block diagram is shown in Fig. 6-4.

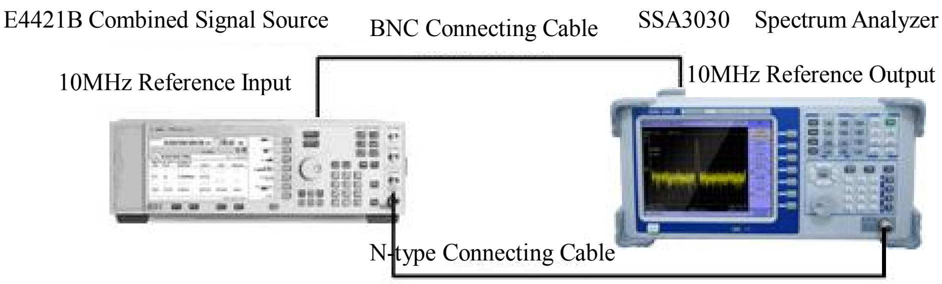


Fig. 6-4 Test Connection Diagram of Noise Sideband

c) Test procedure

(1) Connect the equipment as shown in Fig. 4.

(2) Reset the combined signal generator and set the frequency of 1.2GHz and the power of -20dBm.

(3) Reset SSA3030, and set:

Center Frequency: 1.2GHz

Sweep bandwidth: 10kHz

Resolution Bandwidth: 100Hz

Reference Level: -10dBm

(4) Set [Peak] and "Freq Marker→Center Freq", "Freq Marker→Ref Level".

(5) Activate "Freq Marker Difference", input 10kHz, turn on the video average, and read the amplitude of frequency marker difference.

(6) Calculate the sideband noise and record in Table A.1.

Sideband noise=frequency marker amplitude – 10log (RBW/1Hz)

d) Test records and data processing

Record the test results in the performance indicator test record table.

5 Test of displayed average noise level

a) Explanation of test item

Displayed average noise level refers to the noise level displayed by spectrum analyzer due to the noise generated inside the spectrum analyzer, when the video bandwidth is narrow enough and there is minimum resolution bandwidth and minimum input attenuation. In SSA3030 spectrum analyzer, the indicator requirement for displayed average noise level (if there is residual response at the test point, it is necessary to fine tune the frequency points of test center) is:

Displayed average noise level (RBW 10Hz): <-124dBm 100MHz

<-122dBm 500MHz

<-120dBm 900MHz

＜-126dBm 1.2GHz
＜-123dBm 1.8GHz
＜-121dBm 2.2GHz
＜-120dBm 2.6GHz
＜-118dBm 3.0GHz

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-5.

Table 6-5: Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Load	Resistance:50Ω	Xi'an Fujitec

The testing block diagram is shown in Fig. 6-5.

SSA3030 Spectrum Analyzer

50 ohm Matched Load

Fig. 6-5 Test Connection Diagram of Displayed Average Noise Level

c) Test procedure

(1) Reset and calibrate SSA3030. Connect the 50Ω load to the input terminal of RF signal as shown in Fig. 6-5.

(2) Set SSA3030 as follows:

Center Frequency: 1200MHz
Sweep Width: 1kHz
Reference Level: -60dBm
Attenuator Setting: 0dB (manual)
Resolution Bandwidth: 10Hz

(3) Turn on "Video Avg" and set the average times to 20 till the average is completed.

(4) Use the frequency marker to read the level (avoid the residual response point) as the displayed average noise level of the current frequency point, and record it.

(5) Refer to Table A.1, and change the center frequency of spectrum analyzer. Repeat steps (3)-(4).

d) Test records and data processing

Record the test results in the performance indicator test record table.

6 Sweep time

a) Explanation of test item

The amplitude modulation signal is displayed on the spectrum analyzer at zero span, and 10 signal regular intervals are displayed on the screen by adjusting the frequency of modulation

signal (triangular wave). Count the frequency of modulation signal and calculate the actual sweep time, and then compare it with the designated time.

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-6.

Table 6-6: Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B

The testing block diagram is shown in Fig. 6-6.

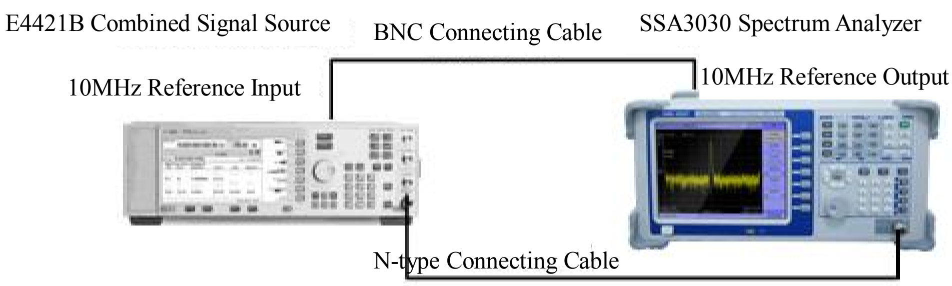


Fig. 6-6 Connection Diagram of Sweep Time

c) Test procedure

(1) Connect test device as shown in Fig. 6-6, and set the combined signal generator as follows:

Frequency: 100MHz

Power: -10dBm

AM modulation: ON

Modulation frequency: 10kHz

Modulation depth: 90%

RF switch: ON

(2) Set SSA3030:

Center frequency: 100MHz

Sweep width: 0Hz

Sweep time: 1ms

Amplitude scale: linear

Resolution bandwidth: 1MHz

(3) Complete a sweep single, activate the frequency marker and place the frequency marker at the second peak on the left. Press “Freq Marker Difference” to place it at the ninth peak.

(4) Read "Freq Marker Difference" and calculate the measured sweep time in the following formula, and record the measuring results. The sweep time of measurement=10 *(freq marker difference / 8)

(5) Set the sweep time to 10ms and repeat steps (1) to (4). Set the modulation frequency of combined signal generator in the following formula: modulation frequency=10/sweep time setting.

d) Test records and data processing

Record the test results in the performance indicator test record table.

7 Conversion compression of mixer

a) Explanation of test item

This test employs two signals with the space of 3MHz to measure the gain compression of spectrum analyzer. It firstly inputs a small signal to spectrum analyzer (lower than -20dBm). After that, a designated large amplitude signal is input into the spectrum analyzer. The amplitude decrease of the first signal caused by the second signal (large amplitude signal) is the gain compression of test.

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-7.

Table 6-7 Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B
2	Combined signal generator	Frequency range:250kHz～4GHz Single band phase noise: <-110dBc/Hz (offset 20kHz) Power output:-120dBm～+20dBm Internal, external AM and FM modulation optional	E4422B
3	Power divider	Frequency range:50kHz～26.5GHz Insert loss:< 6dB Equivalent output SWR:<1.22:1	
4	Power meter	Power range:calibrated in dBm,dB relative reference power -70dBm～+20dBm Power probe: frequency range:50MHz～18GHz SWR: 1.15 (50MHz～100MHz)	Host: HP437B or AV2432 Probe: HP8485A and HP8487D or AV23211

		1.10 (100MHz～2GHz) 1.15 (2.0GHz～12.4GHz) 1.20 (12.4GHz～18.0GHz)	

The testing block diagram is shown in Fig. 6-7.

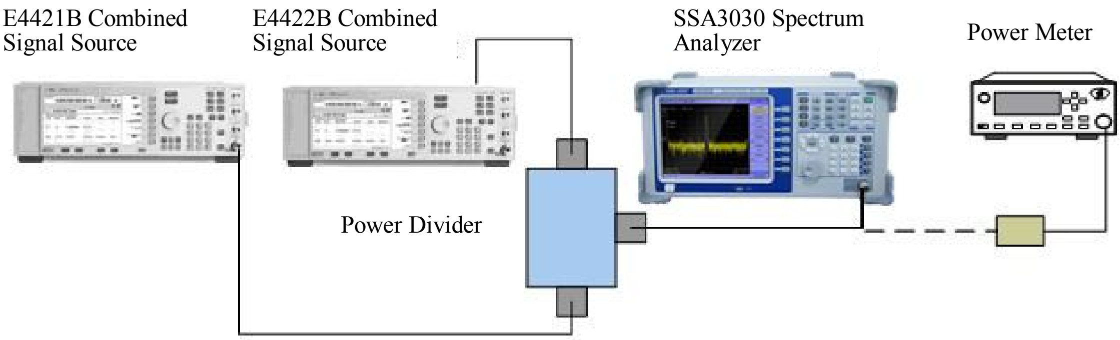


Fig. 6-7 Test Connecting Diagram of Mixer Conversion Compression

c) Test procedure

(1) Refer to the operation manual of power meter, zero adjust and calibrate the power meter and power probe in the logarithmic form.

(2) Connect the equipment as shown in Fig. 6-7, connect the power probe to combination S-port of power divider. E4421B and E4422B are connected to P1 and P2 ports of power divider respectively.

(3) Rest E4421B and E4422B combined signal generators and SSA3030 spectrum analyzer.

(4) Set the frequency of E4421B to 1.203GHz and its power level of -10 dBm.

(5) Set the frequency of E4422B to 1.2GHz and its power level of -20 dBm.

(6) Set SSA3030 as follows:

Center frequency: 1.2GHz
Sweep width: 10MHz
Resolution bandwidth: 300kHz
Reference level: -30dBm
Logarithmic scale: 1dB/lattice

(7) Adjust the power of E4421B combined signal generator and set the reading of power meter to -15dBm. Set the RF OFF.

(8) Take off the power probe from the combination S-port of power divider, and connect the combination S-port of power divider to the input terminal of SSA3030.

(9) Press [Peak] of SSA3030 and set the frequency indicated by frequency marker as the center frequency.

(10) Adjust the signal power level of E4422B combined signal generator, and make the measured signal of SSA3030 lower than the reference level of 1dB.

(11) Activate the [Freq Marker Difference] function of SSA3030.

(12) Set the combined signal generator E4421B to RF ON.

(13) Read the amplitude of frequency marker difference, and record it in Table A.1. Its

absolute value should be lower than 1dB.

d) Test records and data processing

Record the test results in the performance indicator test record table.

8 Second harmonic distortion

a) Explanation of test item

The RF output of combined signal generator provides the signal for spectrum analyzer through low pass filter to measure the second harmonic distortion. The low pass filter can eliminate any harmonic distortion from signal generator.

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-8.

Table 6-8 Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B

The testing block diagram is shown in Fig. 6-8.

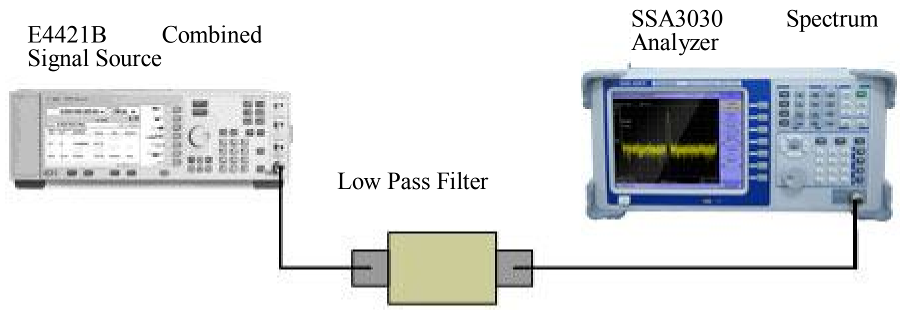


Fig. 6-8 Test Connection Diagram of Second Harmonic Distortion

c) Test procedure

(1) Connect the equipment as shown in Fig. 6-8.

(2) Reset the combined signal generator and set its frequency of 45MHz and its power of -40dBm.

(3) Reset SSA3030 and set it as follows:

Center Frequency: 45MHz
Sweep Width: 10kHz
Reference Level: -40dBm
Resolution Bandwidth: 100Hz
Video Bandwidth: 30Hz

(4) Adjust the signal power of combined signal generator and display the signal peak at the first lattice on the screen.

(5) Press the [Single] key of SSA3030 and wait till the end of sweep. Activate the frequency marker peak search function to place the frequency marker at the signal peak, and then activate [Freq Marker Difference].

(6) Set the center frequency of SSA3030 to 90MHz to facilitate the measurement of second harmonic.

(7) Press the [Single] key of SSA3030 and wait till the end of sweep, and then press the [Peak] key.

(8) Record the amplitude of frequency marker difference as the value of second harmonic distortion in Table A.1. Its value should be within the specified range.

d) Test records and data processing

Record the test results in the performance indicator test record table.

9 Three-order IMD

a) Explanation of test item

Two combined signal generators provide the signals needed to measure the three-order IMD.

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-9.

Table 6-9 Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B
2	Combined signal generator	Frequency range:250kHz～4GHz Single band phase noise: <-110dBc/Hz (offset 20kHz) Power output:-120dBm～+20dBm Internal, external AM and FM modulation optional	E4422B
3	Power divider	Frequency range:50kHz～26.5GHz Insert loss:< 6dB Equivalent output SWR:<1.22:1	
4	Power meter	Power range:calibrated in dBm,dB relative reference power -70dBm～+20dBm Power probe: frequency range:50MHz～18GHz	Host: HP437B or AV2432 Probe: HP8485A and HP8487D or

		SWR: 1.15 (50MHz～100MHz) 1.10 (100MHz～2GHz) 1.15 (2.0GHz～12.4GHz) 1.20 (12.4GHz～18.0GHz)	AV23211

The testing block diagram is shown in Fig. 6-9.

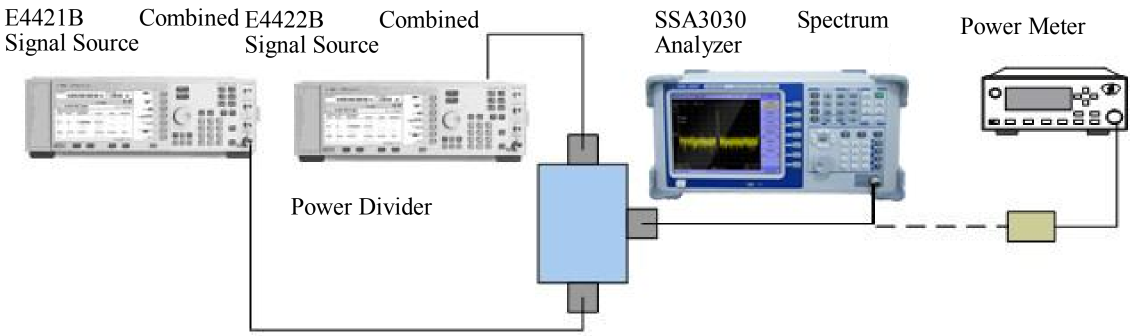


Fig. 6-9 Test Connection Diagram of Three-order IMD

c) Test procedure

(1) Connect the equipment as shown in Fig. 6-9 and connect the power probe to the combination S-port of power divider.

(2) Reset E4421B and E4422B combined signal generators, and set as follows: both their powers are -30dBm, the frequency of E4421B signal generator is 1200MHz, the frequency of E4422B signal generator is 1200.05MHz, and the RF switch is in the "OFF" mode.

(3) Reset SSA3030 and set it as follows:

Center frequency: 1200.025MHz

Reference level: -30dBm

Sweep width: 500kHz

Resolution width: 3 kHz

RF attenuator: 0dB

(4) Place E4421B signal generator in the mode of "RF ON", and adjust the power to -30dBm.

(5) Take off the power probe from power divider, and use the connecting cable to directly connect the combination S-port of power divider to the RF input terminal of SSA3030.

(6) Set the RF switch of E4422B combined signal resource to the "ON" mode, and adjust the power level to make two signals display the same amplitude.

Note: If necessary, adjust SSA3030 center frequency and display two signals in the center of the screen.

(7) Press the [Peak] key of SSA3030 and place the normal frequency marker on either of two signals.

(8) Observe two products of three-order IMD, of which one is displayed at the place lower than the lower signal of 50kHz and the other is displayed at the place higher than the higher signal of 50kHz. Activate the frequency marker difference to the intermodulation signal.

(9) Since the input attenuation during test is 0dB, it is necessary to deduct 20dB from the

frequency marker difference to calculate the intermodulation performance indicator and record it in Table A.1.

d) Test records and data processing

Record the test results in the performance indicator test record table.

10 Test of residual response

a) Explanation of test item

Test the residual responses of wave band 0 and wave band 1, and connect the input terminal of spectrum analyzer to 50Ω matched load.

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-10.

Table 6-10 Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Load	Resistance:50Ω	Xi'an Fujitec

The testing block diagram is shown in Fig. 6-10.

Fig. 6-10 Test Connection Diagram of Residual Response

c) Test procedure

(1) Connect the RF input terminal of SSA3030 to the 50Ω matched load as shown in Fig. 6-10.

(2) Reset and calibrate SSA3030, and set the start frequency of 1MHz and the stop frequency of 11MHz.

(3) Activate the frequency marker and set SSA3030 as follows:

Reference level: -50dBm

RF attenuator: 0dB

Resolution bandwidth: 1 kHz

Display line: -80 dBm

Frequency step: 9 MHz

(4) Wait till the completion of sweep, and observe whether there is any residual response higher than display line. If it is confirmed that there is any residual response higher than display line, record it as the maximum amplitude.

(5) Press [Center Freq] and the [⇑] key, and repeat step (4) till the stop frequency is higher than 100MHz.

(6) Rest SSA3030 and set it as follows:

Center frequency: 150 MHz
Frequency step: 90 MHz
RF attenuator: 0dB
Sweep bandwidth: 100 MHz
Reference level: -50 dBm
Resolution bandwidth: 5 kHz
Display line: -80 dBm

(7) Wait till the completion of sweep and observe whether there is any residual response higher than display line. If it is confirmed that there is any residual response higher than display line, record its amplitude and frequency point.

(8) Press [Center Freq] and the [⇑] key, and repeat step (7).

(9) Repeat step (7) till the measurement within the range of 1MHz～3GHz is completed.

d) Test records and data processing

Record the test results in the performance indicator test record table.

11 Reference level accuracy

a) Explanation of test item

Review the SSA3030 RF attenuator and IF gain error. In each test, a signal displays near the frequency level. When the input signal level decreases, it is also necessary to reduce the reference level of spectrum analyzer. Thus, the signal level decreases by the accurate step, and any difference between reference level and signal level is caused by the RF attenuator and IF gain of spectrum analyzer.

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-11.

Table 6-11 Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B
2	Power divider	Frequency range:50kHz～26.5GHz Insert loss:< 6dB Equivalent output SWR:<1.22:1	
3	Power meter	Power range:calibrated in dBm,dB relative reference power -70dBm～+20dBm Power probe: frequency range:50MHz～18GHz	Host: HP437B or AV2432 Probe: HP8485A and HP8487D or

		SWR: 1.15 (50MHz～100MHz) 1.10 (100MHz～2GHz) 1.15 (2.0GHz～12.4GHz) 1.20 (12.4GHz～18.0GHz)	AV23211

The testing block diagram is shown in Fig. 6-11.

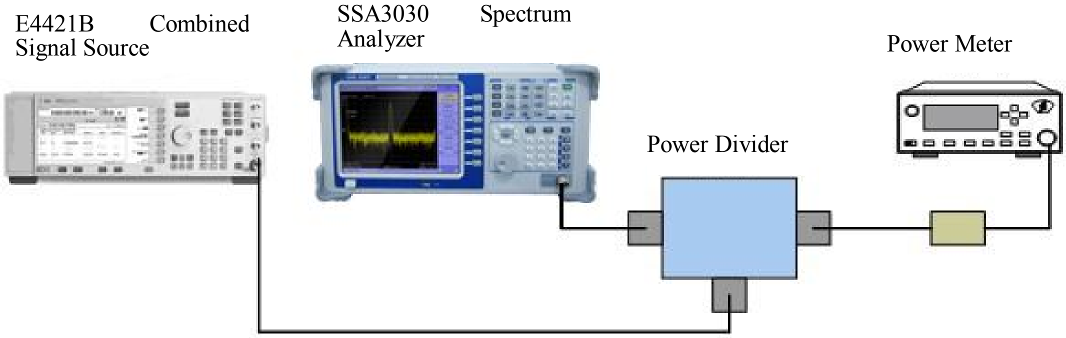


Fig. 6-11 Test Connection Diagram of Reference Level Accuracy

c) Test procedure

(1) Refer to the operation manual of power meter, zero adjust and calibrate the power meter and power probe in the logarithmic form.

(2) Reset E4421B combined signal generator, and set the frequency of 500MHz and the power of 0dBm.

(3) Reset and calibrate SSA3030 and then set it as follows:

Center frequency: 500MHz

Reference level: 0dBm

Sweep bandwidth: 50kHz

Resolution bandwidth: 3 kHz

Attenuator: auto

(4) Connect the equipment as shown in Fig. 11. Adjust the power of combined signal generator to ensure that the reading of power meter is equal to the set reference level.

(5) Trigger the SSA3030 sweep single function, and press [Peak] and [Freq Marker→Center Freq].

(6) Read the frequency marker level, calculate and record the reference level accuracy:

Reference level accuracy= frequency marker level value – power meter reference value

(7) Set the power of combined signal generator and SSA3030 reference level according to Table A.1, and repeat steps (4)～(6).

d) Test records and data processing

Record the test results in the performance indicator test record table.

12 Logarithmic scale accuracy

a) Explanation of test item

The accuracy is tested at 10dB/lattice. The test is performed at the resolution bandwidth of 500Hz, and the start amplitude of input signal is set to 0dBm reference leve. When the signal amplitude decreases, the displayed signal amplitude is compared with the reference level.

b) Testing block diagram and testing device and equipment

The required testing devices are shown in Table 6-12.

Table 6-12 Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B

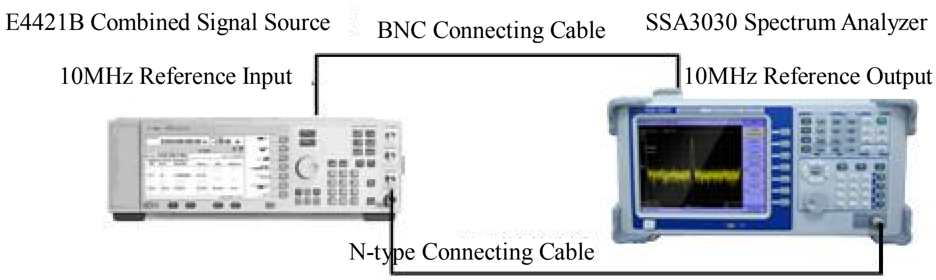


Fig. 6-12 Test Connection Diagram of Display Scale

c) Test procedure

(1) Connect the equipment as shown in Fig. 6-12.

(2) Reset the combined signal generator, and then set the frequency of 500MHz and the power of -1dBm.

(3) Reset and calibrate SSA3030, and set it as follows:

Center Frequency: 500MHz

Reference level: 0 dBm

Sweep Bandwidth: 10 kHz

Resolution Bandwidth: 500 Hz

Press the [Peak] key

(4) Adjust the power output of combined signal generator to set the reading of frequency marker amplitude to 0dBm.

(5) Activate the [Freq Marker Difference] function of SSA3030.

(6) Set the power step of combined signal generator to 10dB.

(7) Make use of the step of combined signal generator to reduce the signal power, and wait till the completion of sweep single of SSA3030.

(8) Press the [Peak] key of AT8030 spectrum analyzer to record the difference between the frequency marker difference and the amplitude of corresponding scale in Table A.1.

(9) Set according to Table A.1, and repeat steps (7)~(8).

d) Test records and data processing

Record the test results in the performance indicator test record table.

13 Frequency response

a) Explanation of test item

This test is performed within a certain range of frequency. Spectrum analyzer displays the degree of unexpected change in the input signals with the same amplitude. In SSA3030 spectrum analyzer, the indicator requirement for frequency response is:

±1.5dB (1MHz ～3.0GHz)

b) Testing block diagram and testing device and equipment

The required testing devices are as shown in Table 6-13.

Table 6-13 Testing Devices

No.	Equipment Type	Recommended Indicator	Recommended Equipment
1	Combined sweep signal source	Frequency range: 250kHz～3GHz Power output: -120dBm～+20dBm Single band phase noise: <-110dBc/Hz (offset 20kHz) Internal, external AM and FM modulation optional	E4421B
2	Power divider	Frequency range:50kHz～26.5GHz Insert loss:< 6dB Equivalent output SWR:<1.22:1	
3	Power meter	Power range:calibrated in dBm,dB relative reference power -70dBm～+20dBm Power probe: frequency range:50MHz～18GHz SWR: 1.15 (50MHz～100MHz) 1.10 (100MHz～2GHz) 1.15 (2.0GHz～12.4GHz) 1.20 (12.4GHz～18.0GHz)	Host: HP437B or AV2432 Probe: HP8485A and HP8487D or AV23211

The testing block diagram is as shown in Fig. 6-9.

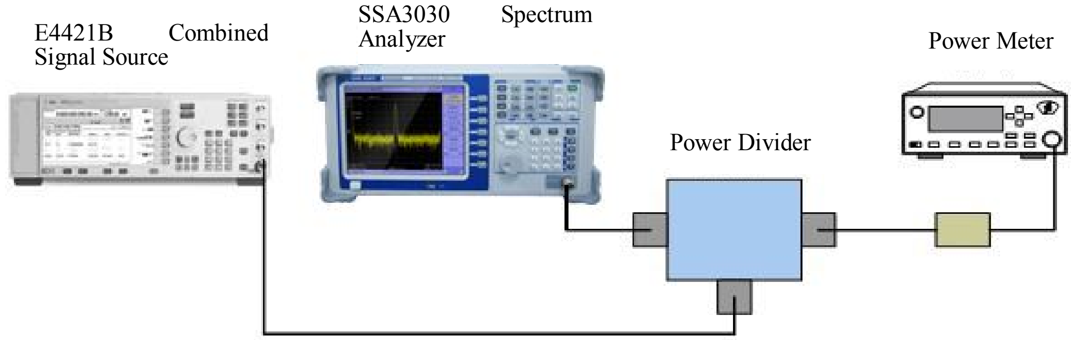


Fig. 6-13 Test Connection Diagram of Frequency Response

c) Test procedure

(1) Refer to the operation manual of power meter, zero adjust and calibrate the power meter and power probe.

(2) Connect the equipment as shown in Fig. 13.

(3) Reset the combined signal generator, and then set the frequency of 100MHz and the power of -10dBm.

(4) Adjust the power of combined signal generator to set the reading of power meter to -10dBm.

(5) Reset and calibrate SSA3030, and set it as follows:

Center Frequency: 100MHz

Reference leve: 0 dBm

Sweep Bandwidth: 200 kHz

(6) Press [Peak] and [Freq Marker→Center Freq] to display the signal peak in the center of the screen.

(7) Set the frequency of combined signal generator, the center frequency of SSA3030 and the calibration frequency of power meter respectively according to the frequencies listed in A.1, and activate SSA3030 frequency marker. Record the reading of SSA3030 frequency marker and the reading of power meter in the corresponding positions of Table A.1, till all the frequency points are tested.

(8) Calculate the testing results: Find out the maximum and minimum in the testing results, calculate the difference and divide it by 2 to obtain the frequency response.

d) Test records and data processing

Record the test results in the performance indicator test record table.

Table 6-14 Performance Test Record Table of SSA3030 Spectrum Analyzer

No.	Test Item				
1	Frequency Reading Accuracy	Center frequency Span 1200MHz 100 kHz 1 MHz 10 MHz 100 MHz	**Min** 1199.999 MHz 1199.99 MHz 1199.9 MHz 1199 MHz	**Measured** ________ ________ ________ ________	**Max** 1200.001 MHz 1200.01 MHz 1200.1 MHz 1201 MHz
2	Span Reading Accuracy	Center frequency Span 1200MHz 100 kHz 1 MHz 10 MHz 100 MHz	**Min** 99.5 kHz 995 kHz 9.95 MHz 99.5 MHz	**Measured** ________ ________ ________ ________	**Max** 100.5 kHz 1.005 MHz 10.05 MHz 100.5 MHz
3	Resolution Bandwidth Switch Uncertainness	Resolution bandwidth Span 3MHz 30MHz 1MHz 10MHz 500KHz 5MHz 300kHz 3MHz 100kHz 1MHz 50kHz 500kHz 30kHz 300kHz 10kHz 100k 5kHz 50kHz 3kHz 30kHz 1kHz 10kHz 500Hz 5kHz 300Hz 3kHz 100Hz 1kHz 50Hz 1kHz 30Hz 1kHz 10Hz 1kHz	**Min** （REF） -0.5 dB	**Measured** 0.0 ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________ ________	**Max** （REF） +0.5 dB
4	Sideband Noise	At Frequency offset 10kHz	**Min**	**Measured** ________	**Max** -80dBc/Hz
Remarks:					

Table 6-14 Performance Test Record Table of SSA3030 Spectrum Analyzer

No.	Test Item				
5	Displayed Average Noise Level	Center Frequency / Resolution Bandwidth	Min	Measured	Max
		100MHz 10Hz	-----	______	-124dBm
		500MHz 10Hz		______	-126dBm
		900MHz 10Hz		______	-120 dBm
		1200MHz 10Hz		______	-126 dBm
		1800MHz 10Hz		______	-123 dBm
		2200MHz 10Hz		______	-121dBm
		2600MHz 10Hz			-120dBm
		3000MHz 10Hz			-118dBm
6	Sweep Time	Sweep Time	Min	Measured	Max
		1ms	995µs	______	1005µs
		10ms	9.95 ms	______	10.05ms
7	Mixer Compression Conversion		Min	Measured	Max
			-----	______	1dB
8	Second Harmonic Distortion		Min	Measured	Max
			-----	______	-60dBc
9	Three-order Intermodulation Distortion		Min	Measured	Max
			-----	______	-60dBc
10	Residual Response		Min	Measured	Max
			-----	______	-80dBm
Remarks:					

Part Three Repair Instructions

Chapter VII Fault Diagnosis and Repair of Spectrum Analyzer

Section 1 Fault Identification and Troubleshooting

The faults of spectrum analyzer may include:

- Abnormal startup
- No signal displayed
- Loss of lock in signal
- Inaccurate reading of signal frequency and amplitude

1. Abnormal startup

Abnormal startup can be further divided into several phenomena including black screen after electrification, failure to enter the system interface, or abnormality after system startup. If the screen is black, please perform the check in the following procedure:

1) Whether the power socket is electrified and whether the external power input meets the requirements of spectrum analyzer.

2) Whether the fuse of power supply is in good condition.

3) Whether the power switch of spectrum analyzer is pressed down.

4) Check the operation of fan.

If it is confirmed that the external power input is correct and the fan does not operate after startup, it is possible that the power supply of spectrum analyzer fails. If it is impossible to enter the system, the CPU of spectrum analyzer fails. If the aforesaid checks are normal, it is possible that the part related to graphic display is broken.

2. No signal displayed

If there is no signal in all the wave bands, it is checked in the following procedure: set the signal generator to the frequency 445MHz, and input the power of 0dBm into the RF input terminal of spectrum analyzer. If it is impossible to observe the signal displayed, it is possible that the hardware circuit of spectrum analyzer may fail. Please contact the manufacturer for elimination.

3. Inaccurate reading of signal frequency

If it is discovered that the signal shakes on the screen of spectrum analyzer or the reading of frequency exceeds the error range during measurement, it is necessary to firstly check whether the frequency of signal input into the spectrum analyzer is stable. If the frequency of input signal is stable, it is necessary to recheck whether the reference of spectrum analyzer is accurate. According to different tests, select the internal reference or external reference. Press [Freq] and [Freq Ref <u>Int</u> Ext], if the frequency reading is inaccurate, it may be caused by the loss of lock in the internal LO of spectrum analyzer, and the instrument must be returned to the manufacturer for repair.

4 Inaccurate reading of signal amplitude

If the reading of signal amplitude is inaccurate, please perform the overall user calibration. If the calibration is completed, the reading of signal amplitude is still inaccurate (the test error is large). It may be caused by some problems in the internal circuit of spectrum analyzer, please

contact the manufacturer for repair.

Section 2 Return of Spectrum Analyzer

When there is any unsolvable problem in your spectrum analyzer, you can contact us by phone or fax. When it is certain that the hardware of spectrum analyzer is damaged and must be returned for repair, it is required to pack the spectrum analyzer with the original packing material and package in the following procedure:

1) Write a detailed description about the faults of spectrum analyzer and put it in the package of spectrum analyzer.
2) Pack the instrument in the dustproof/anti-static plastic bag in order to reduce the possible damage.
3) Place the pads at four corners of external carton and then place the instrument into the external carton.
4) Seal the carton opening with tape and use the nylon tape to reinforce the carton.
5) Mark the carton with “Fragile! No Touch! Handle with Care!”.
6) Check it as the precise instrument for transport.
7) Keep the copies of all transport documents.

Description: If any other material is used to seal the spectrum analyzer, it may damage the instrument. Do not use polystyrene microspheres as the packing material, as they cannot sufficiently hold the instrument, and may be sucked by generated static electricity into the fan to damage the spectrum analyzer.

Contact Information

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Appendix A: Definitions

Envelope Detector

It is the detection circuit along with envelope output (which is not the transient variable of input signal), and sometimes known as peak detector. In a superheterodyne spectrum analyzer, the input of envelope detector is from the final intermediate frequency while the output is the video signal. When the span of spectrum analyzer is set to 0, the envelope detector will demodulate the input signal. At that time, we can observe the modulation signal as the function of time on the screen.

Local Oscillator

It is short for local oscillator. The IF of superheterodyne receiver is the sum frequency or beat frequency generated by system LO and received signal. The LO feed-through is the response on the display when the spectrum analyzer is tuned to 0Hz, in other words, the LO is tuned to be equal to the size of the first IF. The LO feed-through can be used as 0Hz frequency mark.

Standard Detection Mode

It is also known as Rosenfell detection mode, and a detection mode for digital display. In the mode, the value at each point is developed based on the increase or decrease of video signal. If the video signal only increases or decreases, it displays the maximum. If the video signal increases and decreases, the display shows the maximum value at the odd point and the minimum value at the even point. In order to prevent the loss of signal at the even point, it can keep the maximum during the period. Nevertheless, it displays the higher one among the stored values at next odd point.

Step

Press the step keys on the front panel or employ the program control order to control the change of corresponding dynamic parameter.

Measuring Unit

The common measuring units of spectrum analyzer are shown in Table 1:

Table 1 Measuring Units

Measuring Parameter	Unit	Abbreviation
Frequency	Hertz	Hz
Power Level	Decibel to Milliwatt	dBm
Power Ratio	Decibel	dB
Voltage	Volt	V
Time	Second	S
Current	Ampere	A

Impedance Ohm	Ohm	Ω

Menu

Display the functions of spectrum analyzer on the screen by pressing the corresponding softkeys on the front panel to activate the functions. The menus may bring out some other related functions for choice.

Reference Level

The calibrated vertical scale on the display is employed as the reference for amplitude measurement. Normally select the top lattice of scale as the reference level

Measuring Range

The power ratio (dB) of maximum signal (normally maximum safety input level) and minimum signal (average noise level) measurable at the input terminal of spectrum analyzer within the scope of given accuracy. The ratio is almost always much higher than the dynamic scope realizable in the single measurement.

Impact Bandwidth

In the principle of equivalent voltage, make the area circled by the voltage response curve of actual analyzer filter equivalent to the voltage response curve of an ideal rectangular filter with the same area, and realize the same height of two curves. The rectangular filter width is known as equivalent impact bandwidth. It is difference from signal bandwidth and noise bandwidth. In the spectrum analyzer, the Gaussian filter is synchronously tuned to the impact bandwidth that is 1.5 times than the bandwidth of 3dB.

Bandwidth Selectivity

It is an indicator to evaluate the capability of spectrum analyzer to identify the signals with different amplitudes. It is the ratio of 60dB bandwidth and 3dB bandwidth for a given filter. The bandwidth selectivity presents us the degree of steepness at the edge of filter. It is also known as selectivity ratio. When the trigger condition occurs in the mode of sweep single, the spectrum analyzer performs only a sweep. Press the key on the front panel or input the program control order to perform the sweep single for spectrum analyzer.

Factor Scale

The unit of value represented by each lattice on the vertical axis of display.

Dynamic Range

The ratio of maximum signal and minimum signal measurable by spectrum analyzer and simultaneously existing at the input terminal at the given uncertainness. It is in dB. It represents the capability to measure the amplitude difference between two signals existing together. The factors affecting the dynamic range include display noise level, internal distortion and noise sideband.

Logarithmic Display

The mode of display in which the vertical deflection on the display changes with the voltage of input signal in the logarithmic form. The display is calibrated by selecting the value at the top lattice line (reference level) and scale factor (dB/lattice). Under such circumstances, the bottom lattice is not scaled. We can select dBm, dBmV, V or W as the unit of reference level or frequency marker.

Multiple Response

An input signal (CW) with a single frequency causes no less than a response on the display, in other words, there is response to two or more LO frequencies. The space of LO frequencies resulting in multiple response is two times than the intermediate frequency.

FFT

It is short for fast Fourier transform. It is the specific mathematic analysis on the time domain signals, and gives the results of frequency-domain analysis.

Resolution

Resolution represents the capability of spectrum analyzer to clearly separate two input signals during response. It is affected by such factors as IF filter bandwidth and its selectivity ratio, LO residual FM, phase noise and sweep time, etc. Most of spectrum analyzers employ LC filter, crystal filter, active filter, digital filter and other methods to realize different resolution bandwidths.

Amplitude Accuracy

Uncertainness of amplitude measured by spectrum analyzer (relatively or absolutely).

Negative Peak Mode

A detection mode used for digital display. In the mode, each displayed point stands for the minimum value of video signals in a part of frequency space or time space represented by the point.

Active Function Area

The area of screen that displays the active functions and status of spectrum analyzer. An active function refers to the function of spectrum analyzer, which is activated by pressing the last key or executing the last program control order.

Mobile Frequency Marker

The frequency marker that locates on the trace and can be directly moved by a control key on the front panel or a program control key.

Trace

Trace consists of a series of data points containing the information of frequency and amplitude. Such a series of data points are often regarded collectively. Trace A and trace B are frequently used trace names of spectrum analyzer.

Spurious Response

The unexpected signal appeared on the display of spectrum analyzer. Its internal distortion products are false responses, same as mirror image and multiple response. These may be harmonic responses or anharmonic responses. Harmonic responses should be the second, third and fourth harmonics of input signal, etc. Anharmonic responses should be intermodulation and residual responses.

Detection Mode

The mode in which simulation information is processed before being digitized and saved in the storage unit. It covers “Positive Peak Mode”, “Negative Peak Mode”, “Standard Mode” and “Sampling Mode”.

Calibration Factor

Since the circuit of spectrum analyzer may often cause the errors in the measuring results, the calibration factor can be employed to calibrate the measuring results.

Image response: Mirror image refers to the signals with different frequencies, which can respond to each other at the same point, in other words, at the same LO frequency on the display. The space of mirror images is two times than the intermediate frequency. For each fundamental wave frequency of LO, there must be a mirror image, which is one IF lower than LO, or one IF higher than LO. Mirror image normally appears only on the spectrum analyzer without preselector.

Intermodulation Distortion

The useless frequency component developed through the interaction of two or more spectrum components with nonlinear characteristic devices (e.g. mixer and amplifier, etc.). The useless component is generated by the sum and difference of fundamental wave and each harmonic. For instance, $f1 \pm f2$, $2f1 \pm f2$ and $2f2 \pm f1$.

Adjacent-channel Power

The measurement of related power since the signal power leaks into the adjacent channel. The measured value is normally the ratio of adjacent channel to channel power.

Zero Span

It means that the LO of spectrum analyzer is fixed at the given frequency, so the spectrum analyzer changes into a fixed tuned receiver and the bandwidth of this receiver is the resolution bandwidth.

Default

The setting of the instrument by manufacturer before delivery, standing for the reset status, selected part or instrument parameters.

Drift

The slow change of signal position on the display, which is caused by LO frequency due to the change of sweep voltage. When drift happens, it may be readjusted without reducing the

frequency resolution.

Frequency Marker

The visible indicating marker that can be placed at any place on the trace on the screen. Data are used to display the absolute values of frequency and amplitude at the frequency marker on the trace.

Frequency Marker Difference

A working mode of analyzer. Cover a fixed reference frequency marker and a mobile frequency marker that can move freely on the trace. The obtained reading is the frequency, amplitude or time difference between two frequency markers.

Frequency Range

The covered range of frequency measurable by spectrum analyzer. For many microwave spectrum analyzers, the maximum frequency range can be expanded by means of external mixer.

Frequency Precision

An indicator to demonstrate the uncertainness of signal frequency or spectrum component.

Frequency Stability

The degree that the signal frequency remains unchanged within a short period or a long period. Normally, it contains the long-term and short-term LO uncertainness. The short-term LO uncertainness may appear as the FM or phase noise at the originally stable signal.

Evenness

The displayed amplitude change corresponding to the tuned frequency range of spectrum analyzer. It stands for the relationship of the displayed signal amplitude change to frequency. The eveness of ±1dB indicates that the difference between maximum and minimum of frequency response of spectrum analyzer is lower than 2dB.

Sampling Detection Mode

A detection mode for digital display. In the mode, the value displayed at each point is the instantaneous value of video signal at the frequency space or time space represented by the point.

Three-order Intermodulation Distortion

Three-order intermodulation distortion generates in a system with two signals. The distortion product is caused by mixing a signal with the second harmonic of another signal. If two main signals have the same power, two three-order distortion products will also have the same power. As the equal power of two main signals increases, the power of distortion product triples. Theoretically, there is a level at which the power of each distortion product is equal to the power of main signals.

Span

The difference between start frequency and stop frequency. The setting of span determines

the scale of horizontal axis on the display of spectrum analyzer.

Span accuracy: The uncertainness of designated frequency space between any two signals on the display.

Sweep Time

The time needed to tune the LO within the selected frequency space. The sweep time directly affects the time to complete one test, which does not cover the dead time between the end of a sweep and the start of next sweep. At zero span, horizontal axis can only calibrate time. When it is not zero span, horizontal axis can calibrate both frequency and time. The sweep time often changes with span, resolution bandwidth and video bandwidth.

Video

The output signal of envelope detector. The frequency range extends from 0Hz to the frequency which is much larger than the largest resolution bandwidth provided by analyzer. The final bandwidth of video gateway is determined by the set video filter.

Video amplifier: The DC coupling amplifier after detector.

Video Filter

A low pass filter designed to adjust the cut-off frequency after envelope detector. When the video bandwidth is equal to or lower than the resolution bandwidth, the video circuit cannot sufficiently respond to the rapid undulation at the output terminal of detector. The result is that the trace is smoothed, or the peak-peak offset between observed noise and pulse radiation frequency at the working mode of bandwidth is reduced. Such an average or smooth degree is related to the ratio of video bandwidth and resolution bandwidth.

Video Average

It is the average at each point during the period of multiple sweeps. At each point, new data and old data are averaged. The display will gradually centralize at the average of several measurements. Only in the analyzer of digital display, the average is determined by the number of sweeps selected by the user. The average logarithm applies the weighting coefficient (1/n, n stands for the current number of sweeps) to the amplitude at the given point of the current sweep, and another weighting coefficient [（n-1）/n] to the average stored before, and then calculate them into the current average. After the designated number of sweeps is completed, the weighting coefficient remains unchanged, while the display changes to the dynamic average.

In the case of multiple measurements, the video filter is basically identical to the video average. However, they still have some differences. The video filter is a real-time average. When measuring a time drifting signal, the difference between them becomes more obvious, and may lead to completely different results. In the video filter, sweeps may bring different averages. In the video average, a result very close to the actual average is obtained since it realizes the sufficient averaging through multiple sweeps.

Radio Frequency Attenuator

The step attenuator between the input connector and the first mixer in the spectrum analyzer.

The RF attenuator is used to adjust the level of signal input into the first mixer, in order to prevent the gain compression caused by high level or bandwidth signal, and control the distortion to set the dynamic range. In some analyzers, if the setting of input attenuator is changed, it is displayed that the vertical position of signal is also changed. In a microprocessor controlled analyzer, the IF gain can be changed to compensate the change of input attenuator. Thus, signals can remain steady on the screen, while the reference level does not change.

Input Impedance

The terminal impedance imposed by analyzer on signal source. The impedance of RF and microwave analyzer is normally 50Ω. In some systems (e.g. cable TV), the standard impedance is 75Ω. The degree of mismatch between rated impedance and actual impedance is represented by voltage standing wave ratio (VSWR).

Refresh Mode

It is used to clear the traces on the screen, and restart the sweep when the trigger condition occurs. When satisfying the trigger condition, the data of new input signal will be displayed.

Residual Frequency Modulation

The uncertainness of innate short-term frequency of oscillator when there is not any other modulation.

Residual Response

The dispersed response observed on the display of spectrum analyzer when there is no input signal.

Prompt

The information displayed on the screen to reveal the hardware failure, the user's wrong operation or any other thing that must be noticed. Normally, the prompt will disappear from the screen when such problem is solved.

Amplitude Modulation Factor

The measurement of amplitude modulation factor for signals. The measured value is the ratio of modulation signal power and modulated signal power. The modulation factor is calculated in the following formula. In the formula, dB stands for the ratio of signal power to amplitude modulation sideband power:

$$AM\% = 200\times10(-dB/20)\ \%$$

Misalignment

It indicates the measurement with misalignment. When the setting of the instrument affects the accuracy of measurement, it will appear on the screen.

Display Fidelity

The uncertainness of measurement for relative deviation of amplitude on the spectrum analyzer. The analyzer with digital display has the frequency marker difference that can be taken

out from the stored data. In this way, it can eliminate the uncertainness of measurement caused by the screen display.

Display Range

The difference between maximum signal and minimum signal, which can be observed on the display at the same time. For a spectrum analyzer with the maximum logarithmic display of 10dB/lattice, the actual dynamic range may be larger than the displayed range.

Display Average Noise Level

The noise level observed on the display of spectrum analyzer at the minimum resolution bandwidth and the minimum input attenuation, after sufficiently reducing the video bandwidth to reduce the peak-peak noise wave. The final noise display is radically a smooth and straight line. Normally, the equivalent for the display average noise level of spectrum analyzer is known as sensitivity, and in dBm. A signal equal to the display noise level will display a convex hull nearly 3dB higher than the display noise level. Commonly, it is considered as the minimum measurable signal level. According to the receiver theory, the relationship between sensitivity and resolution bandwidth is as follows:

$$Pin = -174dBm + FdB + 10LogB$$

In which:

FdB stands for the receiver noise coefficient

B stands for the receiver 3dB bandwidth (in Hz)

The best sensitivity can be obtained by the instrument at the smallest resolution bandwidth, the minimum input attenuation and the sufficient video filter. Nevertheless, the best sensitivity may conflict with other measurement demands. For instance, the lower resolution bandwidth will increase the sweep time, while 0dB input attenuation will increase the voltage standing wave ratio (VSWR) at the input terminal.

Linear Display

The display mode when there is the direct proportion between the vertical deflection and the input signal voltage on the display. The bottom lattice line on the screen stands for 0V, while the top lattice line represents the reference level (depending on a value of the specific spectrum analyzer other than zero). Scale factor is equal to the product of dividing reference level by number of lattices. Although there is a linear display, the spectrum analyzer should still allow the dBm, dBmV, dBuV, W and V to display the reference level and frequency marker value.

Relative Amplitude Accuracy

The uncertainness of amplitude measurement. The amplitude of a signal is compared with that of another signal, regardless of any absolute amplitude among them. The uncertainness is affected by such factors as frequency response, display fidelity, change of input attenuation, IF gain, scale factor and resolution bandwidth.

Harmonic Mixing

The LO harmonic is employed for mixing to expand the tuning measurement range of spectrum analyzer.

Harmonic Distortion

The useless frequency component added to signals due to the nonlinear characteristics of devices (e.g. mixer and amplifier, etc.). These useless frequency components are related to original signal harmonics.

Channel Power

The overall average power within the designated bandwidth.

Hard Copy

Input the information or data on the paper instead of storing them in the register of the instrument.

Noise Frequency Marker

It is used to represent the noise power within the 1Hz noise bandwidth. When selecting the noise frequency marker, the sampling detection mode is initiated to average several trace points around the frequency marker (the number of points depends on the analyzer). The average normalizes the equivalents within 1Hz noise power bandwidth. Normalization considers the effect of detector and logarithmic amplifier.

Noise Sideband

It represents the uncertainness of LO short-term frequency in the spectrum analyzer. Since sideband is noise, its level against spectrum component changes with the resolution bandwidth. The noise sideband is often in dBc/Hz (power within 1Hz bandwidth of relative carrier frequency). The carrier frequency is the spectrum component observed on the display. The noise sideband is also known as phase noise.

Gain Compression

When the mixer of spectrum analyzer is close to the saturated working point, the signal level displayed by spectrum analyzer is quite low, which is caused by gain compression. Normally, it is specified that the signal level is regularly between -3dBm and -10dBm at the 1dB or 0.5dB compression point.

Occupied Bandwidth

The measurement of frequency bandwidth occupied by the carrier wave of transmitter. The carrier power within the occupied bandwidth is normally 99% of overall carrier power. Thus, it is also known as “99% power bandwidth”. Its measurement is determined by high-end and low-end frequency limits.

Positve Peak Mode

A detection mode used for digital display. In the mode, each displayed point stands for the maximum value of video signals in a part of frequency space or time space represented by the point.

Intermediate Frequency Gain/Intermediate Frequency Attenuation

The controller used to adjust the vertical position of signal on the display without affecting the signal level of input mixer. When changing the controller, the reference level is changed correspondingly.

Intermediate Frequency Feed-through

The IF input signal can raise the fundamental line of display through the input mixer. Normally, this is a potential problem only when there is no preselected spectrum analyzer. Since the signal is always at the IF, there is no need of LO mixing. Thus, the whole trace goes up.

Status Register

The user's register space used to store the measuring results and the related settings of analyzer.

Quasi-peak Detector

The objective effect of pulse interference on human's hearing increases along with the increase of repetition frequency. Such effect can be roughly reflected by the output characteristics of quasi-peak detector with the specific time constant. Since the quasi-peak does not only reflect the amplitude of interference signal, but also reflect its time distribution. Thus, its charging time constant is higher than the peak detector, while its discharging time constant is lower than the peak detector.

Maximum Input Level

The allowed input maximum safety power at the input terminal of spectrum analyzer. Normally, the continuous wave is 2W (＋33dBm).

Appendix B: Maintenance and Cleaning

General Maintenance

Do not place the instrument at the place exposed to sunlight for a long time.

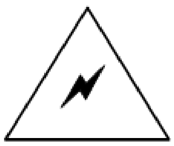
Be Careful

Do not allow any corrosive fluid to stain the instrument, in order to prevent any damage to the instrument.

Cleaning

Frequently clean the instrument based on its use. The method is as follows:

1. Use the wet soft fabric without dripping to wipe off the dust at the surface of the instrument. When cleaning the LCD, be careful not to scratch the transparent LCD protection screen.



Warning: **Before electrifying again, please confirm whether the instrument is completely dry, in order to prevent any damp from causing its short circuit and even personal injury.**
